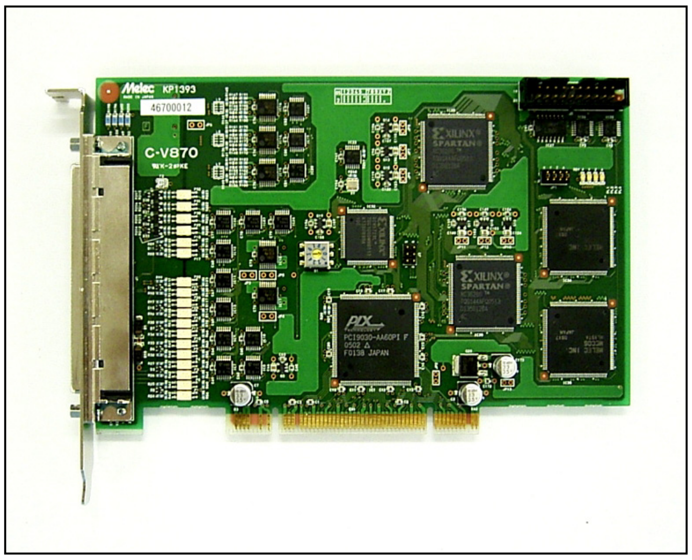
Melec



Stepping & Servo Motor Controller

C-V870

Instructions Manual

(For designers' use)

USER'S MANUAL

Please ensure to read and understand this Instructions Manual before using the Product. Please keep this Instructions Manual at hand so that it is always available for reference.

MN0064

Introduction

This instructions manual explains the handling of "Stepping Motor and Servo Motor Controller C-V870," emphasizing the specifications to enable proper and safe use. The manual is thus intended for designers of control systems using stepping motors or servo motors.
Before using the product, read this manual carefully for better understanding.
Keep the manual handy so that you can read it whenever you want.

The C-V870 allows four axes to be controlled independently and therefore the first axis is referred to as the X axis, the second as the Y axis, the third axes as the Z axis, and the fourth axis as the A axis.
This manual basically explains only the X axis.
The interpolation command handles the X and Z axes the same and the Y and A axes the same.

Description of Safety

This product must be handled correctly.
Handling the product incorrectly may cause unexpected accidents resulting in personal injuries or damage to your properties.
Many of those accidents can be avoided if you have advance information on dangerous situations. This manual provides precautions where dangerous situations are predicted. The manual provides the following alert marking and messages for this purpose:

▲ WARNING	This indicates a hazardous situation that could result in death or serious personal injury if you do not perform the procedure correctly.
⚠ CAUTION	This indicates a potentially hazardous situation that could result in personal injury or physical damage if you do not perform the procedure correctly.

Before Use

■ This product is not designed for use in the equipment related to nuclear power, aerospace equipment, vehicles, marine vessels, medial equipment directly in touch with human body, equipment anticipated to give a serious impact to properties, and other equipment required to provide high reliability.

■ Take failsafe measures so that the whole system operates safely even if the input power causes an error, a signal line is disconnected, or the main unit fails.

■ This product is equipped with a LIMIT (overtravel) signal and an FSSTOP signal to prevent mechanical damage.
The initial values of these signals are set to ACTIVE OFF (B contact). Accordingly, even in a system configuration in which the FSSTOP and LIMIT signals are not used, pulses are not output unless NORMAL ON (GND connection) is enabled.

■ Be sure to use this product within the scope of the specifications described in this instruction manual in accordance with the specification method described therein.

■ Set up the product before operating it.
Refer to Section 3, "Setup."

■ For details of the applied functions referred to in this manual, refer to separate manual "Technical Data A."

■ For detailed information on commands and execution sequences, refer to separate manual "Instructions Manual (Commands)"

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1-1. Features

The C-V870 is a controller equipped with four independently functioning axes to enable 2-axis linear interpolation (X/Y-axes interpolation and Z/A-axes interpolation) or 2-axis circular interpolation (X/Y-axes interpolation and Z/A-axes interpolation) driving. This controller supports servo and stepping motors that can directly be inserted into slots of a PCI bus system conforming to PCI bus specifications R2.2.

Using an applied function of the interpolation drive enables linear interpolation among an arbitrary number of axes or circular interpolation between two axes in different combinations.

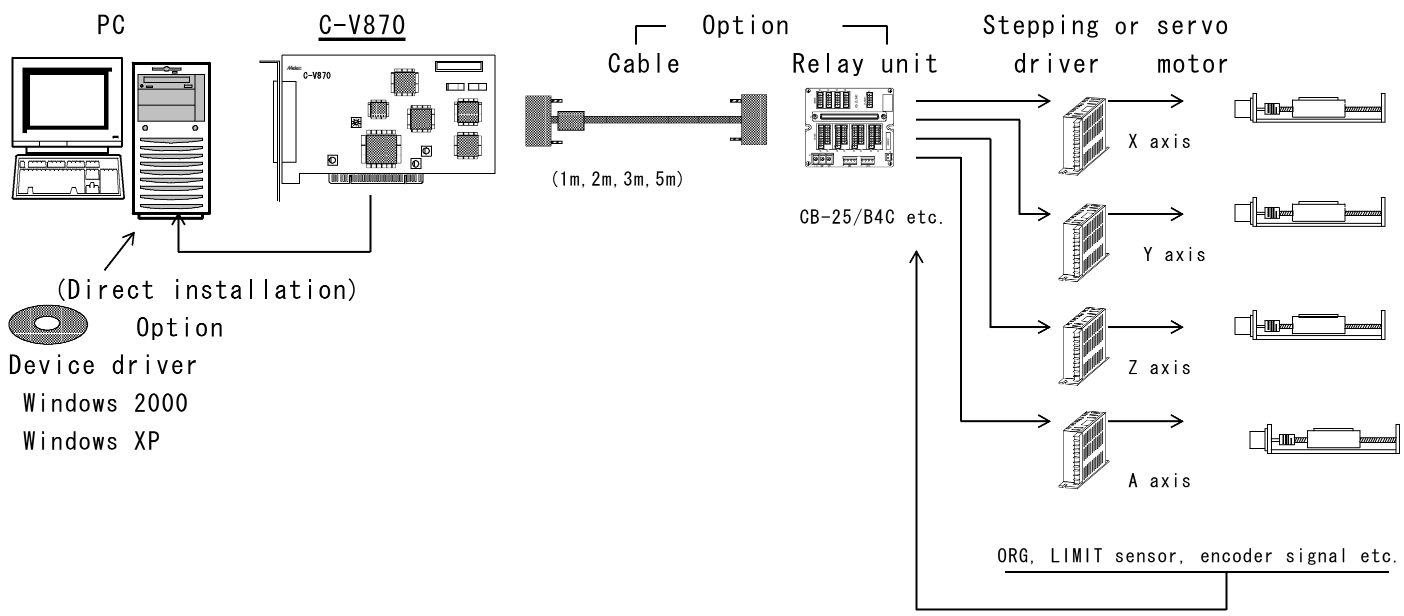
The board shape is the universal short card size (107 x 170) of the PCI bus standard.

The C-V870 is equipped with our chip controller MCC06 to enable motor control using simple commands. The 32-bit width address counter and the maximum output frequency of 5 MHz of the MCC06 enables high-precision, high-speed positioning. Also equipped with a multi-functional 32-bit pulse counter, pulse differential counter, and pulse cycle counter, the C-V870 has a variety of applications such as counting feedback pulses from the servo driver, detecting step-out of the stepping motor with an encoder, and monitoring the speeds of the pulses that are actually output. The applications also include interrupt output and external signal output using the comparator function of each counter.

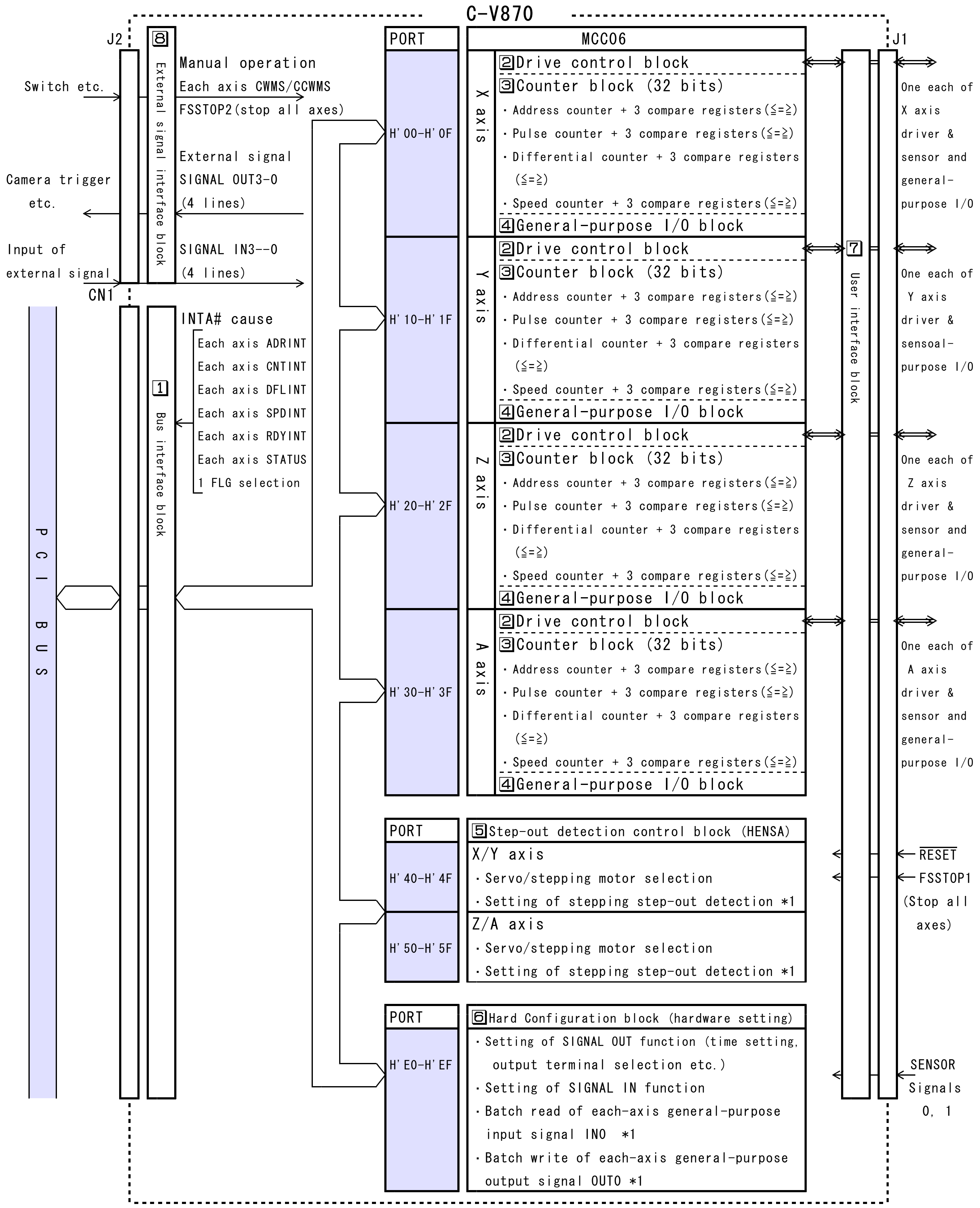
1-2. Product Configuration

Product name	Rating	Maker	Quantity	Remarks
Controller	C-V870	Melec Inc.	1	(Main unit)

1-3. Example of System Configuration



1-4. Function Block Diagram



*1 Application function. Refer to the separate manual「Technical Data A.」

1 Bus interface block
Interface block with the PCI bus

2 Drive control block
The drive control block indicates pulse generator MCC06, which outputs serial pulses to the motor driver.
It enables 2-axis linear interpolation or 2-axis circular interpolation as well as individual driving of four axes.
Using an applied function of the interpolation drive enables linear interpolation among an arbitrary number of axes or circular interpolation between two arbitrary axes. In addition, the command reservation function (applied function) allows you to use an FIFO reservation register that can reserve eight instructions, each consisting of a set of data and a command. The commands thus stored in the reservation register can be executed sequentially after the command currently in execution is finished.

3 Counter block
The counter block indicates the counters in pulse generator MCC06, which contains four types of 32-bit counters: address counter, pulse counter, pulse differential counter, and pulse speed counter, each equipped with three compare registers.
These counters count pulses output by the C-V870 or external clock signals such as feedback signals from the encoder. The counter block has the function for constantly reading counts, auto reload function for automatically resetting counter values, AUTO CLEAR function for automatically clearing counter values, and the function for causing an interrupt at a specified count value (or difference) detected by the comparator.

4 General-purpose I/O block
One input and one output isolated by the photo coupler are provided for each axis.
Having a +24 V interface, the block can control relays, solenoid valves, servo ON/OFF, and break ON/OFF.

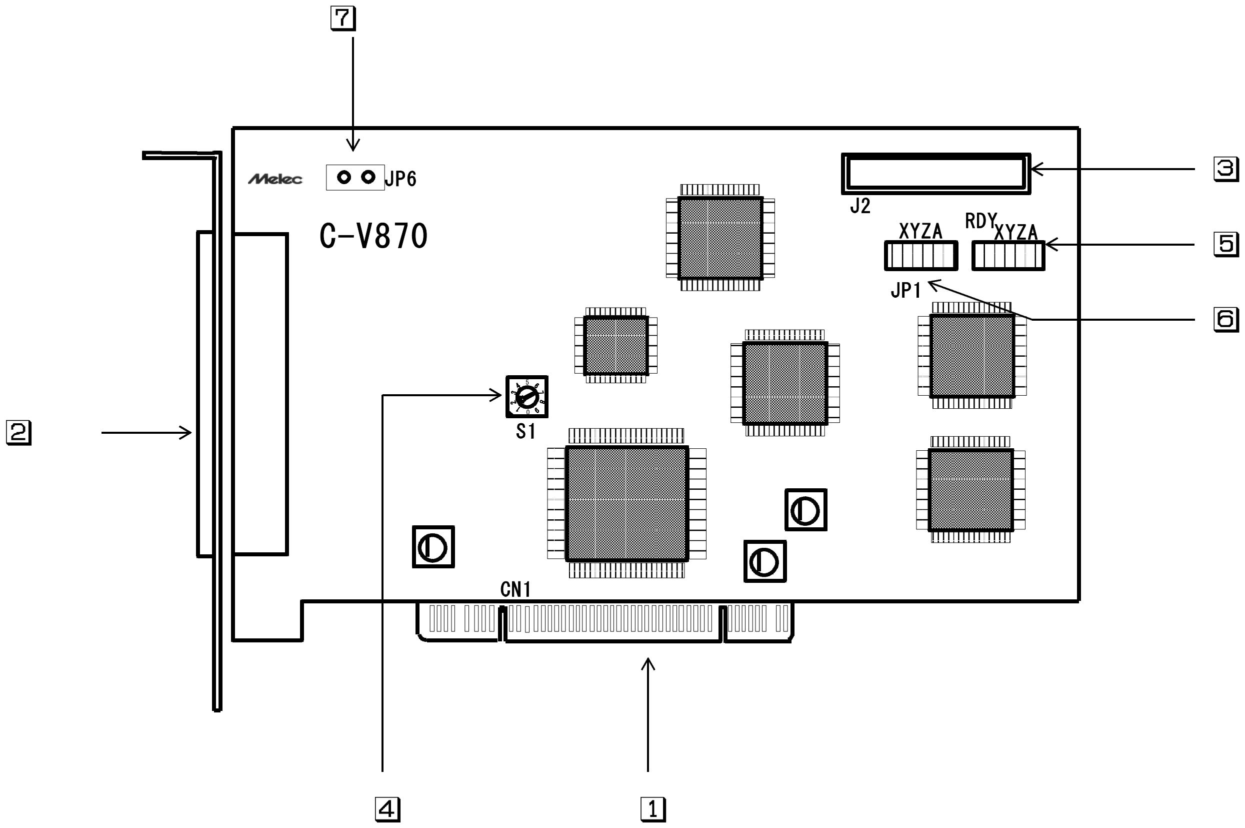
5 Step-out detection control block
Setting the stepping motor and servo driver using this setting block changes to the hardware specifications of the signals required to control each motor. After this changing, the settings and function required for motor control can be used by MCC06 servo commands. This block also works as a control block that can detect step-out of the stepping motor. If the stepping motor steps out, pulses are stopped and a driver error is reported to DALM in the MCC06 STATUS2 PORT. (Applied function)
The control block concerning step-out detection is hereafter referred to as HENSA.

6 HARD CONFIGURATION block (hardware setting)
The HARD CONFIGURATION block is a control block that allows the user to change the settings of C-V870 input/output signals.
The user can set the function and axes for output to external signals (SIGNAL OUT3-0) and can also set hardware specifications such as output time. The user can also set the function and axes for input to MCC06 from external input signals (SIGNAL IN3-0, SENSOR0, SENSOR1).
The applied function can collectively read general-purpose I/O provided for each axis in 4 from the HARD CONFIGURATION PORT or collectively write them.

7 User interface block
The user interface block interfaces with motor drivers, sensors, and general-purpose I/O equipment signals.

8 External signal interface block
Motors can be operated manually using external signals.
This function is effective for operating motors independent of PC programs.
The signals of the axis and function selected in 6 can be output to the outside upon comparator detection of each counter in 3.
This interface function allows the user to build a real time system independent of external equipment and PC OSs.

1-5. External view



1 CN1 -------- Universal (5 V/3.3 V) board edge connector inserted into a PCI bus slot

2 J1 ---------- 100-pin half pitch connector that interfaces the motor driver, sensor signals, and equipment having +24 V interface I/O.
Dedicated interface cables (1m, 2m, 3m, and 5m) are available.

3 J2 ---------- Connector that interfaces with external signals at TTL level.
Motors can be operated by manual operation through this connector.
Also, signals can be output to the outside by comparator detection of each counter.
External input signals can be assigned as input signals to MCC06.
(PAUSE signal for synchronization control, SS0 and SS1 signals for the SENSOR drive, and SLSTOP signal for deceleration and stop)
A general-purpose standard MIL connector is used.

4 S1 ---------- Rotary switch that is set so that PCI can recognize the board number.
If two or more boards are inserted into the PC simultaneously, set the switch properly so that every board number is unique.

5 RDY LED -- LEDs that allows the user to simply monitor the X, Y, Z, and A axes to check whether the axes are operating normally. The RDY LED corresponding to each axis is on while the axis is waiting for a command and is off during command processing.

6 JP1 --------- Jumper connector used for manual operation through the J2 connector. This connector is used to switch the initial specifications of the drive parameters used to operate MCC06.
By default (before shipment from the factory), all jumper plugs are inserted to set the initial specifications of the MCC06 drive parameters to the LOW type.

7 JP6 --------- Removing the jumper plug of JP6 can prevent output of D.GND with the same potential as PC internal GND at pins 50 and 100 of the J1 connector.
By default (before shipment from the factory), the jumper plug is inserted so that D.GND is output.

2. SPECIFICATIONS

2-1. PCI Specifications

<table>
<tr><th>No.</th><th>Item</th><th>Specifications</th></tr>
<tr><td>1</td><td>Applicable standard</td><td>PCI Local Bus Specification Rev2.2</td></tr>
<tr><td>2</td><td>Bus interface</td><td>・32-bit bus (internal 16 bits), 33 MHz clock
・Signal system universal (3.3 V/5 V)</td></tr>
<tr><td>3</td><td>PCI Configuration Register</td><td>
<table>
<tr><td colspan="2">31 16</td><td colspan="2">15 0</td><td>Offset</td></tr>
<tr><td colspan="2">Device ID (H'10A0)</td><td colspan="2">Vendor ID (H'152E)</td><td>H'00</td></tr>
<tr><td colspan="2">Status</td><td colspan="2">Command</td><td>H'04</td></tr>
<tr><td>Base Class(H'0E)</td><td>Sub Class (H'80)</td><td>Prog.I/F (H'00)</td><td>Revision ID(H'00)</td><td>H'08</td></tr>
<tr><td>BIST</td><td>Header Type(H'00)</td><td>Latency Timer</td><td>Cache Line Size</td><td>H'0C</td></tr>
<tr><td colspan="4">Base Address Register０ : Reserved</td><td>H'10</td></tr>
<tr><td colspan="4">Base Address Register１ : Reserved</td><td>H'14</td></tr>
<tr><td colspan="4">Base Address Register２ : Base Address for C-V870</td><td>H'18</td></tr>
<tr><td colspan="4" rowspan="3">Reserved</td><td>H'1C</td></tr>
<tr><td>H'20</td></tr>
<tr><td>H'24</td></tr>
<tr><td colspan="4">Cardbus CIS Pointer</td><td>H'28</td></tr>
<tr><td colspan="2">Subsystem ID (H'10A0)</td><td colspan="2">Subsystem Vendor ID (H'152E)</td><td>H'2C</td></tr>
<tr><td colspan="4">Expansion ROM Base Address : Reserved</td><td>H'30</td></tr>
<tr><td colspan="4">Reserved</td><td>H'34</td></tr>
<tr><td colspan="4">Reserved</td><td>H'38</td></tr>
<tr><td>Max_Lat</td><td>Min_Gnt</td><td>Interrupt pin(H'01)</td><td>Interrupt Line</td><td>H'3C</td></tr>
</table>
</td></tr>
<tr><td>4</td><td>Interrupt</td><td>・INTA#
Various interrupts including ADRINT, CNTINT, DFLINT, SPDINT, RDYINT, status, and general-purpose output can individually be masked to select interrupt factors.
・Interrupts can be cleared individually by execution of the INT FACTOR CLR command.</td></tr>
<tr><td>5</td><td>Dimensions</td><td>Universal short card size (107mm×170mm×17mm)</td></tr>
</table>

2-2. General Specifications

No.	Item	Specifications
1	Supply voltage, power consumption	・+5 V ±5%, 1.0 A or less ・+24 VDC ±2 V, 200 mA or less (for photocoupler interface)
2	Operating ambient temperature and humidity	・0℃ ～ ＋45℃ ・80%RH以下 (without dew condensation)
3	Storage temperature and humidity	・0℃ ～ ＋55℃ ・80%RH以下 (without dew condensation)
4	Installation environment	・Inside a well-ventilated cabinet installed indoor, free from direct sunlight ・Not exposed to corrosive and flammable gasses, and not affected by oil mist, dust,salt, iron powder, water, and chemicals ・Not subject to constant vibration or excessive shock ・Not affected by electromagnetic noise caused by power equipment ・Free of radioactive materials and magnetic fields, and not in vacuum
5	Weight	・About 0.2 kg

2-3. Basic Specifications

No.	Item	Specifications	
1	Number of control axes	4 axes	・4 independent axes ・2-axis linear interpolation x 2 (X, Y axes and Z, A axes) ・2-axis circular interpolation x 2 (X, Y axes and Z, A axes)
2	Pulse output function	Output type	・Independent direction output ・phase-differential signal output: multiplier is 2 or multiplier is 4 . ・Line driver output
		Output frequency	・1 Hz to 5 MHz (can be set in 1 Hz steps)
		Acceleration/deceleration time constant	・1000 ms/kHz to 0.016 ms/kHz ・Time constants for acceleration and deceleration can be set individually.
		Number of output pulses	・JOG drive: 1 pulse ・SCAN drive: Up to infinite pulses ・INDEX drive: -2,147,483,647 to + 2,147,483,647 pulses
		External signal output	・External signals such as hand pulser signals that are input to the EA and EB signals of each axis can be output as external synchronous clock signals.
3	Encoder function	Input frequency	・3.3 MHz (when independent direction signals are input) ・Double phase-differential signal input: multiplier is 2 or multiplier is 4 .
		Input range	・±2,147,483,647
		Input type	・Incremental ・Line receiver input
		Input of external pulse signal	・External pulse signals can be input as count pulses for individual counters including the address counter.
4	Drive function	JOG drive	・Only a single pulse is output.
		SCAN drive	・Pulses are continuously output until a stop command is detected. ・Set the pulse speed in units of 1 Hz in the range from 1 Hz to 5 MHz. ・The acceleration/deceleration time constant can be set by selecting a number from the RATE DATA TABLE in the range from 1,000 ms/kHz to 0.016 ms/kHz. ・The acceleration and deceleration time constants can be set asymmetrically to enable asymmetrical linear acceleration/ deceleration drive, asymmetrical S-shaped acceleration/ deceleration drive, and constant speed drive. ・The pulse speed can freely be changed during drive.
		INDEX drive	・Pulses are output until the specified relative or absolute address is reached. ・The relative and absolute addresses range from -2,147,483,647 to +2,147,483,647 (32 bits). ・As with the SCAN drive, asymmetrical acceleration/ deceleration drive can be performed and stopped at the specified position after automatic deceleration. ・The pulse speed and the specified address can be changed during drive.
		END PULSE drive	・Dumping at stop of the motor can be suppressed. ・Acceleration/deceleration drive is finished just before the value set for END (SEND) PULSE, and drive is performed at the speed set for ESPD (SESPD) to the INDEX-specified position.
		ORIGIN drive (machine origin detection function)	・Various drive processes for sensor detection are sequentially performed. Drive is finished when the machine origin signal is detected. ・ORIGIN drive includes nine drive types: ORG-0 to 5, 10, 11, and 12. The sensor signals detected in ORG-0 to 5 and 10 are ORG and NORG detection signals generated by synthesizing ORG, NORG, and Z-phase or PO signal input. The sensor signals detected in ORG-11 and 12 are CWLM or CCWLM. ・The machine original signal can be detected by execution of a single command if an adequate drive type is selected.
		MANUAL SCAN drive	・MANUAL SCAN drive in the + or - direction is performed by operation of MAN, CWMS, or CCWMS signal input through the J2 connector. ・The drive parameters for the MANUAL SCAN drive are the initial values after reset or the current values. ・During SCAN drive, the drive CHANGE function related to speeds can be used in parallel. (Applied function)

No.	Item	Specifications	
4	Drive function (continued)	2-axis linear interpolation drive	・2-axis linear interpolation drive, and 2-axis linear interpolation drive under linear speed constant control can be performed. ・Linear interpolation is performed toward the specified coordinates from the current coordinates. Positional errors for the specified straight line are ±0.5 LSB. ・The absolute and relative addresses that can be specified for coordinates range from -2,147,483,647 to +2,147,483,647 (32 bits). ・As with INDEX drive, asymmetrical acceleration/deceleration drive can be used for positioning.
		2-axis circular interpolation drive	・2-axis circular interpolation drive, and 2-axis circular interpolation drive under linear speed constant control can be performed. ・Circular interpolation is performed toward the specified coordinates from the current coordinates on the circular curve specified by the center-point or passing-point coordinates. ・Positional errors for the specified circuit curve are ±1 LSB for center-point circular interpolation or ±2 LSB for passing-point interpolation. ・The absolute addresses that can be specified for coordinates range from -2,147,483,647 to +2,147,483,647 (32 bits). The relative addresses range from -8,388,607 to +8,388,607 (24 bits). ・As with INDEX drive, asymmetrical acceleration/deceleration drive can be used for positioning.
		Linear speed constant control	・Control is performed to keep the synthesized speed of the two axes working for interpolation drive constant. ・When two axes output pulses simultaneously, the next pulse output cycle is multiplied by 1.414.
5	Counter function	Address counter	・32-bit counter that manages absolute addresses by counting drive output pulses ・Three dedicated comparators are used to detect a specific count and output ADRINT that requests a counter interrupt. ・Upon detection of a match by the comparator, pulse output can be decelerated and then stopped, or stopped immediately.
		Pulse counter	・32-bit counter that manages actual positions by counting external pulse signals ・Three dedicated comparators are used to detect a specific count and output CNTINT that requests a counter interrupt. ・Upon detection of a match by the comparator, pulse output can be decelerated and then stopped, or stopped immediately.
		Pulse differential counter	・32-bit counter that detects differences in the number of pulses by counting any two types of pulse signals ・Three dedicated comparators are used to detect a specific count value and output DFLINT that requests a counter interrupt. ・Upon detection of a match by the comparator, pulse output can be decelerated and then stopped, or stopped immediately. ・By count specification selection, this counter can also be used as a pulse counter that counts any one type of pulse signals.
		Pulse cycle counter	・32-bit counter that measures one cycle of any type of pulses by counting 20 MHz reference clock signals ・Three dedicated comparators are used to detect a specific measurement value and output SPDINT that requests a counter interrupt. ・Upon detection of a match by the comparator, pulse output can be decelerated and then stopped, or stopped immediately. ・Because this counter measures time, it can also be used as a 32-bit timer.
		Count data latch/clearance function	・This function latches count data of a counter at a specific latch timing and holds it till the next latch timing. ・Latch data can be read at any time. ・The count data of a counter can be cleared at detection of latch timing.

No.	Item	Specifications	
5	Counter function (continued)	Ring counter function	・The address counter, pulse counter, and pulse differential counter each are a ring counter in which any maximum count can be set. ・You can perform position management of the rotary axis if you set the number of circling pulses for rotation as the maximum count.
		Auto reload function	・Data can automatically be reloaded upon detection of a match of COMP1 of each counter.
		AUTO CLEAR function	・The counter can automatically be cleared upon detection of a match of COMP1 of each counter (excluding the address counter).
6	Stop function	Immediate stop signal	・FSSTOP1 (All axes stop immediately. : J1 connector) ・FSSTOP2 (All axes stop immediately. : J2 connector)
		LIMIT signal	・Stopped by each LIMIT sensor (CWLM, CCWLM) ・Immediate stop by LIMIT and slow stop can be selected.
		Counter detection	・Slow stop or immediate stop can be performed for each axis upon detection of a match of the comparator of each counter.
		SENSOR signal stop	・By setting the input function, the SENSOR signal at the J1 connector can be used as the slow stop or immediate stop signal for each axis by SENSOR signal input. ・Although the initial value is assigned to the Z or A axis, it can also be reassigned to the X or Y axis.
		DALM signal stop	・General-purpose input signal IN0 of each axis at the J1 connector can be selected for the DALM signal function. ・By setting the DALM input function, the DALM signal can be used as the slow stop or immediate stop signal for each axis.
7	Read function	Status read Data reading	・Current status information can be read in real time. Current status information includes pulse control, interrupt request output, I/O signal, counter comparator output, speed of drive pulses being output, count data of a counter, latch data of a counter etc.
		Check function	・The check command can be used to check the details of an error and setup data.
8	Other functions	Multipurpose sensor signal input and synchronization signal input	・SENSOR0 and SENSOR1 signals that are input can be used as trigger signals that execute various MCC06 functions, pulse output stop signals, UP/DOWN/CONST drive CHANGE operating signals, and SENSOR drive detection signals. ・Although the initial value is assigned to the Z or A axis, it can also be reassigned to the X or Y axis. Two lines of SENSOR signals can be assigned as SS0 and SS1 signal inputs to a specific axis so that SENSOR drive can be used with two sensors. ・These signals can also be used as synchronization signals (PAUSE signal) from outside.
		Synchronized start function	・By setting the release condition of the PAUSE signal, you can perform synchronized start with any axis or external signal.
		Servo driver support function	・Servo reset output and servo positioning completion input are specially prepared as servo driver support signals. ・General-purpose input signal IN0 can be set for DALM input and can be used even with a stepping motor.
		External signal output	・The compare register value, STATUS, and general-purpose output signal of each counter can be selected and output from the J2 connector. ・From the compare register of each counter, data can be through-output and one-shot output is enabled by changing the output time width in microseconds from 1 microsecond to 65.535 ms. ・Inputting that signal output, as a camera trigger signal, into external equipment enables real-time synchronization control independent of the OS. ・The matching signals of pulse counter CNTINT and differential counter DFLINT of the X and Y axes are output as the initial values. These signals can be switched to the outputs of the Z and A axes. ・ADRINT and SPDINT of other counters can be output to any axis.

2-4. Applied Functions

For details on the following applied functions, refer to separate manual "Technical Data A."

No.	Item	Description of specifications	
1	Number of control axes	Multi-chip interpolation function	・Linear interpolation of the X, Y axes and Z, A axes can be applied to linear interpolation between any two axes or between any number of axes. ・Circular interpolation of the X, Y axes and Z, A axes can be applied to 2-axis circular interpolation in other combinations. Other axes can be operated independently.
2	Pulse output function	Compute mode acceleration/deceleration time constant	・Standard acceleration/deceleration rates from 1,000 ms/kHz to 0.016 ms/kHz can be set as desired in the range from 1,048.56 ms/kHz to 0.0125 ms/kHz in compute mode.
		ELSPD setting function	・The start speed and end speed can be set separately.
3	Encoder function	Input frequency	・Default input frequency 3.3 MHz can be changed to 5 MHz.
4	Drive function	UP/DOWN/CONST drive CHANGE function	・Drive change for acceleration, deceleration, or constant speed can be performed upon detection of "active" signal at an arbitrary change operation point. ・Upon detection of the UP DRIVE command, the system accelerates up to the maximum speed. ・Upon detection of the DOWN DRIVE command, the system decelerates down to the start speed. ・Upon detection of the CONST DRIVE command, the system changes to constant-speed drive.
		SPEED CHANGE function	・The drive pulse speed is changed upon detection of "active" signal at an arbitrary change operation point. ・Upon detection of the SPEED CHANGE command the system accelerates or decelerates to the specified drive pulse speed. ・For the linear acceleration/deceleration drive or the SRATE SCAN drive for which the SOFT LIMIT function is disabled, the speed can be changed to above the maximum speed or below the start speed.
		RATE CHANGE function	・Upon detection of the RATE CHANGE command during linear acceleration/deceleration drive, the rate of acceleration/deceleration in execution and the acceleration/deceleration rate during speed change by the drive CHANGE function are changed to the specified rate.
		INDEX CHANGE function	・Upon detection of "active" signal at an arbitrary change operation point, the stop position at which drive is to be finished is changed. ・Upon detection of the INC INDEX CHANGE command, the system performs INC INDEX drive by setting the specified data at the stop position of the relative address for which the start position is the origin. ・Upon detection of the ABS INDEX CHANGE command, the system performs ABS INDEX drive by setting the specified data at the stop position of the absolute address managed with the address counter. ・Upon detection of the PLS INDEX CHANGE command, the system performs INC INDEX drive by setting the specified data at the stop position of the relative address for which the detection position of the change operation point is the origin.
		AUTO CHANGE drive	・The change function is executed when a change point is detected during linear acceleration/deceleration drive. ・Change points and change functions can be set at up to 128 positions. ・Specify a change point using a relative address, drive pulse speed, or relative time in units of 1 ms. ・The change function means the changing of the drive pulse speed or acceleration/deceleration rate, or the execution of the stop function. ・The drive CHANGE function can also be used in parallel.

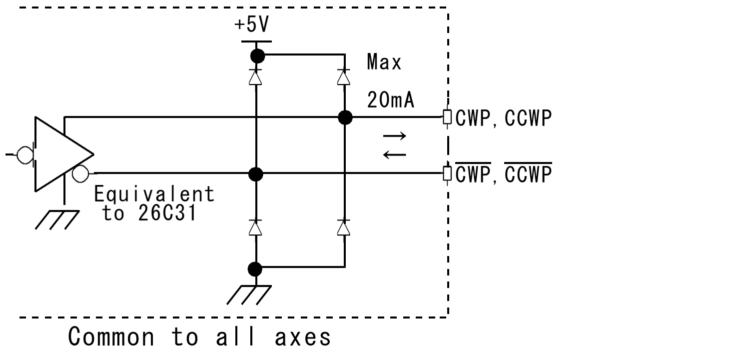
No.	Item	Description of specifications	
5	Other functions	Command reservation function	・The MCC06 has a reservation register that can store data commands for eight instructions. ・General-purpose commands of Drive commands can be reserved in the reservation register. The reservation register uses FIFO. After the command being executed is finished, the commands stored in the reservation register are executed sequentially. * Special command of Drive commands and Counter commands cannot be reserved.
		SOFT LIMIT function	・A soft limit can be set inside a hard limit. ・To not go beyond the soft limit, the system automatically decelerates and stops at the soft limit address.
		Triangular drive prevention function	・During S-shaped acceleration/deceleration drive, INDEX drive may end before the maximum speed is reached or a slow stop command may be entered. In this event, triangular drive can be automatically avoided.
		Input signal logical switch function	・B-contact input logic of a limit signal can be changed to A-contact without replacing the sensor.
		General-purpose I/O batch processing function	・General-purpose I/O signals (IN0 and OUT0) are prepared, as I/O signals with the motor drive, for each axis. Through MCC06 port access, these signals for four points for each axis can be read or written in a batch at the HARD CONFIGURATION PORT.
		Stepping motor step-out detection	・Step-out can be detected as an error in an open loop of the stepping motor. ・Upon detection of an error, the system promptly stops and reads from the DALM signal.

2-5. Input and Output Specifications

(1) Output specifications

●Output specifications 1

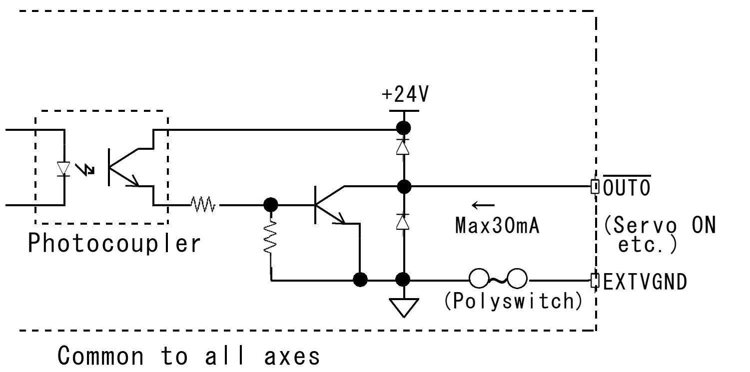
Circuit



Description	
Signal name	CWP, $\overline{CWP}$, CCWP, $\overline{CCWP}$
Output method	Line driver (differential) output (Equivalent to 26C31: Compliant with RS422A)
Output current	±20mA
Output frequency	Maximum 5 MHz
Insulation	Non-insulated

●Output specifications 2

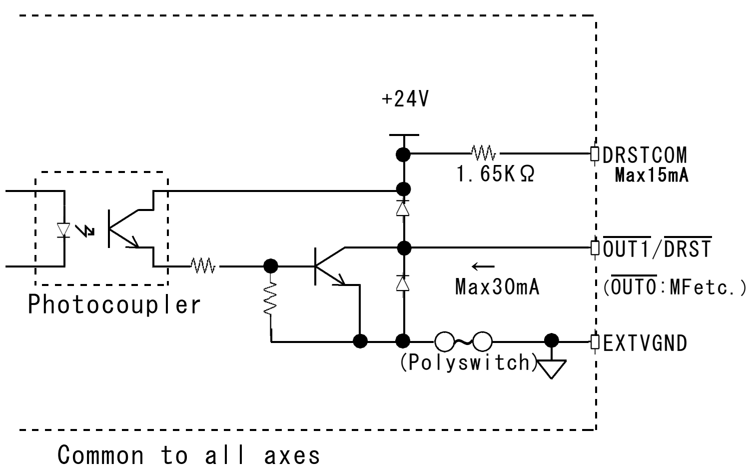
Circuit



Description	
Signal name	$\overline{OUT0}$
Interface voltage	+24V
Output method	Nch transistor Open collector output
Output current	ON : 30 mA (Vce = 1 V or less) 50 mA (Vce = 2 V or less) OFF: 0.1 mA or less
Output response time	1 ms or less (ON→OFF、OFF→ON)
Insulation	Photocoupler insulation (between internal circuits and external circuits)

●Output specifications 3

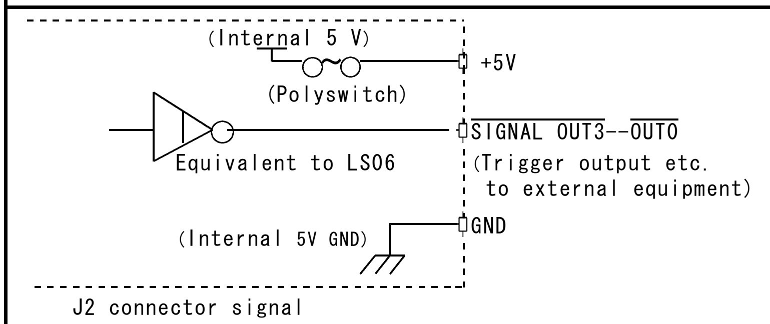
Circuit



Description	
Signal name	$\overline{OUT1}$ /$\overline{DRST}$ (Can be connected from DRSTCOM to the +5 V current limiting circuit: up to 15 mA)
Interface voltage	+24V
Output method	Nch transistor Open collector output
Output current	ON : 30 mA (Vce = 1 V or less) 50 mA (Vce = 2 V or less) OFF: 0.1 mA or less
Output response time	1 ms or less (ON→OFF、OFF→ON)
Insulation	Photocoupler insulation (between internal circuits and external circuits)

●Output specifications 4

Circuit

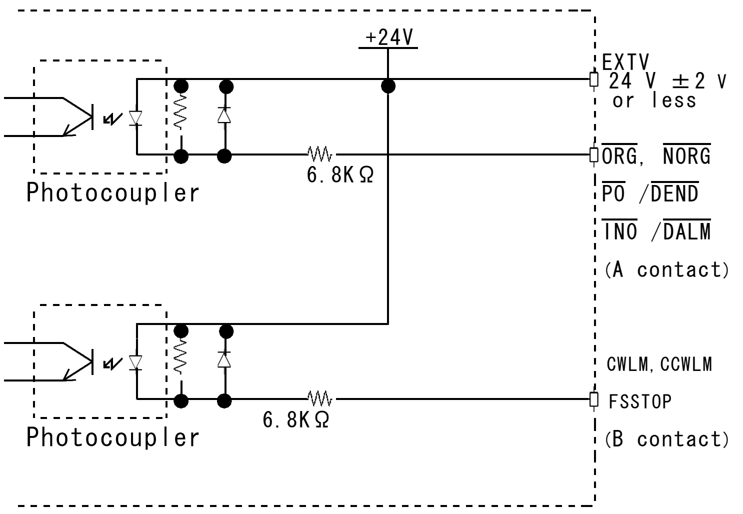


Description	
Signal name	$\overline{SIGNAL\ OUT3}$--$\overline{OUT0}$
Interface voltage	+30 V or less
Output method	Open collector output
Output current	ON : 10 mA (Vce =0.6 V or less) OFF: 0.3 mA or less
Output response time	1μs or less (A latch and output time width can be set for output.) (ON→OFF、OFF→ON)
Insulation	Non-insulated

(2) Input specifications

● Input specifications 1

Circuit

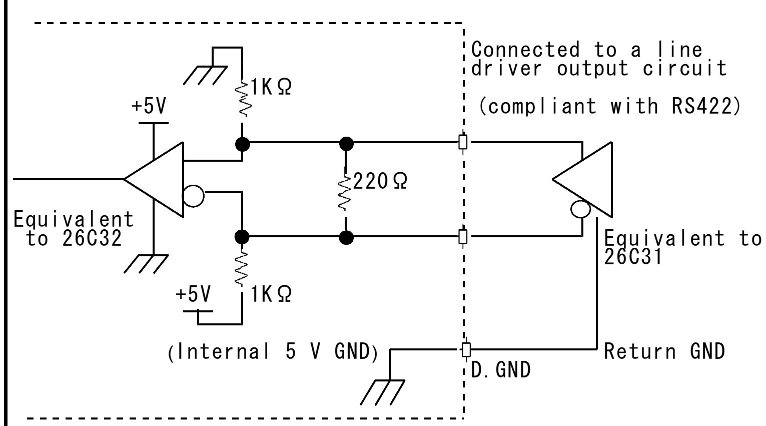


Common for all axes
(Excluding FSSTOP1, SENSOR0 and SENSOR1)

Description	
Signal name	ORG, NORG, PO/DEND , INO/DALM SENSOR0, SENSOR1, RESET (A contact) FSSTOP1, CWLM, CCWLM (B contact)
Interface voltage	+24V
Input impedance	6.8KΩ
ON/OFF level	ON :2.5 mA or more OFF :0.8 mA or less
Input response time	1 ms or less (ON→OFF、OFF→ON)
Insulation	Photocoupler insulation(between internal circuits and external circuits)

● Input specifications 2

Circuit

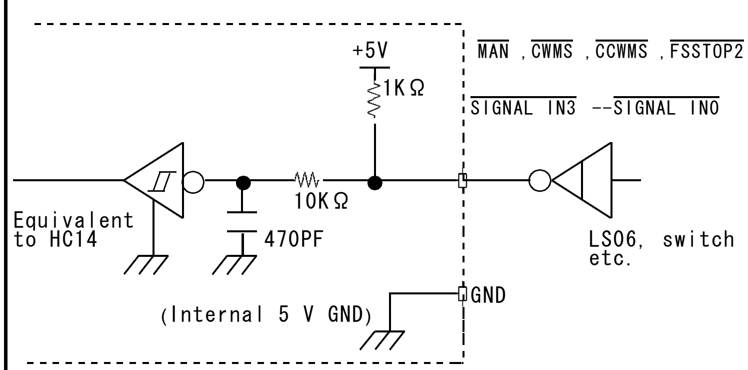


Common for all axes

Description	
Signal name	±EA、±EB、±ZORG
Interface specifications	Line receiver input(should be connected to an RS422-compliant line driver)
Input terminating resistor	220Ω
Response frequency	±EA,EB : 5MHz(initial value: 3.3 MHz) ±ZORG : 100KHz
Insulation	Non-insulated

● Input specifications 3

Circuit



J2 connector signal

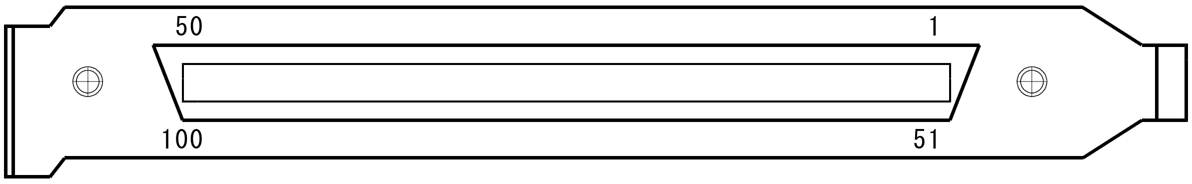
Description	
Signal name	MAN, SIGNAL IN3--IN0(SEL_D--A), CWMS, CCWMS, FSSTOP2
Interface specifications	TTL level CMOS schmitt input
Input level	High level open
	Low level 0.8 V or less
Input response time	10μs or less (ON→OFF、OFF→ON)
Insulation	Non-insulated

2-6. Input and Output Signal Table

(1) J1 connector

■Pin assignments

●Connector type name : DX10A -100S(50) (HIROSE Electric)
●Adaptable socket : DX30A -100P(50) ,DX31A -100P etc.
(Hirose Electric, not included in attached accessories)
●Adaptable cable : 1 m , 2 m, 3 m, or 5 m shielded cable (option)



■Signal table

⚠CAUTION	This product may be damaged. Do not connect +24 V to any pin other than EXTV. After wiring, be sure to confirm the wiring before power-on.

● A signal indicated by [shaded box] is photocoupler-insulated.

● A signal marked with ※ can be switched.
An underline indicates the initial value after the relevant signal is reset.

● Logic switching is enabled for an input signal marked with ★.

(Note 1)
Origin signal used when a stepping motor is used Leave this signal unconnected when the Z-phase signal of an encoder is used as the origin signal.

(Note 2)
An external power supply is required for a signal that is photocoupler-insulated.
The specified input voltage range is +24 V ±2 V, and current consumption at +24 V is up to 200 mA.
The initial values of the CWLM and CCWLM signals of each axis and the FSSTOP1 signal are ACTIVE OFF input (B contact).
An external power supply must be connected even if these signals are not used.
◆The default contact B is recommended for the limit and FSSTOP signals. However, A-contact signal input can also be used by switching logic.
＊For more information, refer to separate manual "Technical Data A."

(Note 3)
By default, the SENSOR0 signal is allocated to the Z axis and the SENSOR1 signal is allocated to the A axis. The initial values of these signals are general-purpose input. These signals can be changed to other axes or SS0 and SS1 signals of the SENSOR drive.
＊For information on the SENSOR drive, refer to separate manual "Technical Data A."

(Note 4)
PO/DEND input is used as the PO (excitation output) signal when STEPPING is used, or used as the positioning completion signal when SERVO is used.

(Note 5)
Each input circuit is a line receiver. Connect it to the line driver output circuit (equivalent to RS422 compliance).

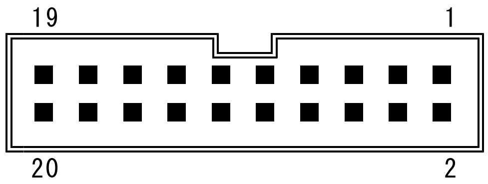
(Note 6)
Internal digital GND. (Same potential as internal GND of PC)
Connect it, for return GND, to the line driver output circuit of the encoder.
Be careful for load short circuits to prevent the PC power supply from failing.
Jumper JP6 on the board can be removed to prevent output of D.GND.

Pin No.	Direc -tion	Signal name	Description	Pin No.	Direc -tion	Signal name	Description
1	In★	XCWLM	X axis + (CW) direction limit signal	51	In★	ZCWLM	Z axis + (CW) direction limit signal
2	In★	XCCWLM	X axis - (CCW) direction limit signal	52	In★	ZCCWLM	Z axis - (CCW) direction limit signal
3	In★	XNORG	X axis machine origin proximity signal	53	In★	ZNORG	Z axis machine origin proximity signal
4	In★	XORG	X axis machine origin signal (Note 1)	54	In★	ZORG	Z axis machine origin signal (Note 1)
5	In★	YCWLM	Y axis + (CW) direction limit signal	55	In★	ACWLM	A axis + (CW) direction limit signal
6	In★	YCCWLM	Y axis - (CCW) direction limit signal	56	In★	ACCWLM	A axis - (CCW) direction limit signal
7	In★	YNORG	Y axis machine origin proximity signal	57	In★	ANORG	A axis machine origin proximity signal
8	In★	YORG	Y axis machine origin signal (Note 1)	58	In★	AORG	A axis machine origin signal (Note 1)
9	In ※★	SENSOR0	Sensor 0 signal (initial value: ZSENSOR) (Note 3)	59	In ※★	SENSOR1	Sensor 1 signal (initial value: ASENSOR) (Note 3)
10	In ※★	XIN0/XDALM	X axis general-purpose input 0 signal/driver error signal	60	Out ※	XOUT0	X axis general-purpose output 0 signal (initial value: no output)
11	In ※★	YIN0/YDALM	Y axis general-purpose input 0 signal/driver error signal	61	Out ※	YOUT0	Y axis general-purpose output 0 signal (initial value: no output)
12	In ※★	ZIN0/ZDALM	Z axis general-purpose input 0 signal/driver error signal	62	Out ※	ZOUT0	Z axis general-purpose output 0 signal (initial value: no output)
13	In ※★	AIN0/ADALM	A axis general-purpose input 0 signal/driver error signal	63	Out ※	AOUT0	A axis general-purpose output 0 signal (initial value: no output)
14	—	EXTV	External power supply for coupler	64	—	EXTVGND	External power supply for coupler
15	—	EXTV	(Note 2)	65	—	EXTVGND	(Note 2)
16	Out	+COM	XCWP, XCCWP +common (+5 V)	66	Out	+COM	ZCWP, ZCCWP +common (+5 V)
17	Out	XCWP	X axis + (CW) direction positive logic pulse	67	Out	ZCWP	Z axis + (CW) direction positive logic pulse output
18	Out	XCWP	X axis + (CW) direction negative logic pulse	68	Out	ZCWP	Z axis + (CW) direction negative logic pulse output
19	Out	XCCWP	X axis -(CCW) direction positive logic pulse	69	Out	ZCCWP	Z axis -(CCW) direction positive logic pulse output
20	Out	XCCWP	X axis -(CCW) direction negative logic pulse	70	Out	ZCCWP	Z axis -(CCW) direction negative logic pulse output
21	Out	XDRSTCOM	XDRST current output (+24 V)	71	Out	ZDRSTCOM	ZDRST current output (+24 V)
22	Out ※	XOUT1/XDRST	X axis general-purpose output 1/differential counter reset signal	72	Out ※	ZOUT1/ZDRST	Z axis general-purpose output 1/differential counter reset signal
23	In ※★	XP0/XDEND	X axis P0 signal/positioning completion signal (Note 4)	73	In ※★	ZP0/ZDEND	Z axis P0 signal/positioning completion signal (Note 4)
24	—	N.C	Reserved	74	—	N.C	Reserved
25	In	+XEA	X axis encoder +A phase signal (Note 5)	75	In	+ZEA	Z axis encoder +A phase signal (Note 5)
26	In	-XEA	X axis encoder -A phase signal (Note 5)	76	In	-ZEA	Z axis encoder -A phase signal (Note 5)
27	In	+XEB	X axis encoder +B phase signal (Note 5)	77	In	+ZEB	Z axis encoder +B phase signal (Note 5)
28	In	-XEB	X axis encoder -B phase signal (Note 5)	78	In	-ZEB	Z axis encoder -B phase signal (Note 5)
29	In	+XZORG	X axis encoder +Z phase signal (Note 5)	79	In	+ZZORG	Z axis encoder +Z phase signal (Note 5)
30	In	-XZORG	X axis encoder -Z phase signal (Note 5)	80	In	-ZZORG	Z axis encoder -Z phase signal (Note 5)
31	—	N.C	Reserved	81	—	N.C	Reserved
32	Out	+COM	YCWP, YCCWP +common (+5 V)	82	Out	+COM	ACWP, ACCWP +common (+5 V)
33	Out	YCWP	Y axis + (CW) direction positive logic pulse signal	83	Out	ACWP	A axis + (CW) direction positive logic pulse signal
34	Out	YCWP	Y axis + (CW) direction negative logic pulse signal	84	Out	ACWP	A axis + (CW) direction negative logic pulse signal
35	Out	YCCWP	Y axis - (CCW) direction positive logic pulse signal	85	Out	ACCWP	A axis - (CCW) direction positive logic pulse signal
36	Out	YCCWP	Y axis - (CCW) direction negative logic pulse signal	86	Out	ACCWP	A axis - (CCW) direction negative logic pulse signal
37	Out	YDRSTCOM	YDRST current output (+24 V)	87	Out	ADRSTCOM	ADRST current output (+24 V)
38	Out ※	YOUT1/YDRST	Y axis general-purpose output 1/differential counter reset signal	88	Out ※	AOUT1/ADRST	A axis general-purpose output 1/differential counter reset signal
39	In ※★	YP0/YDEND	Y axis P0 signal/positioning completion signal (Note 4)	89	In ※★	AP0/ADEND	A axis P0 signal/positioning completion signal (Note 4)
40	—	N.C	Reserved	90	—	N.C	Reserved
41	In	+YEA	Y axis encoder +A phase signal (Note 5)	91	In	+AEA	A axis encoder +A phase signal (Note 5)
42	In	-YEA	Y axis encoder -A phase signal (Note 5)	92	In	-AEA	A axis encoder -A phase signal (Note 5)
43	In	+YEB	Y axis encoder +B phase signal (Note 5)	93	In	+AEB	A axis encoder +B phase signal (Note 5)
44	In	-YEB	Y axis encoder -B phase signal (Note 5)	94	In	-AEB	A axis encoder -B phase signal (Note 5)
45	In	+YZORG	Y axis encoder +Z phase signal (Note 5)	95	In	+AZORG	A axis encoder +Z phase signal (Note 5)
46	In	-YZORG	Y axis encoder -Z phase signal (Note 5)	96	In	-AZORG	A axis encoder -Z phase signal (Note 5)
47	—	N.C	Reserved	97	—	N.C	Reserved
48	In★	FSSTOP1	All axes immediate stop signal	98	In	RESET	All-axis reset signal
49	—	N.C	Reserved	99	—	N.C	Reserved
50	—	D.GND	Internal +5 V digital GND (Note 6)	100	—	D.GND	Internal +5 V digital GND (Note 6)

(2) J2 connector

■ Pin assignments

- ●Connector type name : XG4C-2031 (OMRON)
- ●Adaptable connector socket : XG4M-2030 (OMRON, not included in attached accessories)
- ●Adaptable cable : MIL 20P 1.5 m flat cable (option)



■ Signal table

Pin No.	Direc-tion	Signal name	Description $\overline{\text{MAN}}$ signal = H	$\overline{\text{MAN}}$ signal = L
1	—	GND	GND(internal +5 V GND)	
2	In	$\overline{\text{MAN}}$	Operation with PCI bus commands	Operation in manual mode
3	In	$\overline{\text{FSSTOP2}}$	When this signal goes low, all axes stops immediately.	
4	In	$\overline{\text{CWMS}}$	Invalid	SCAN drive is performed in the CW direction while this signal is low.
5	In	$\overline{\text{CCWMS}}$	Invalid	SCAN drive is performed in the CCW direction while this signal is low.
6	—	GND	GND(internal +5 V GND)	
7	In※	$\overline{\text{SIGNAL IN0}}$ / SEL A	Initial value: No signal allocation	The SEL A, B, C, and D signals
8	In※	$\overline{\text{SIGNAL IN1}}$ / SEL B	External signals can be allocated	can be combined to select the
9	In※	$\overline{\text{SIGNAL IN2}}$ / SEL C	to any axes and used as PAUSE, SS0,	axis used for manual operation.
10	In※	$\overline{\text{SIGNAL IN3}}$ / SEL D	SS1, and SLSTOP signal inputs.	(Note 1)
11	Out※	$\overline{\text{SIGNAL OUT0}}$	Initial value: X axis CNTINT (can be switched to any other axis and output signal)	
12	Out※	$\overline{\text{SIGNAL OUT1}}$	Initial value: Y axis CNTINT (can be switched to any other axis and output signal)	
13	Out※	$\overline{\text{SIGNAL OUT2}}$	Initial value: X axis DFLINT (can be switched to any other axis and output signal)	
14	Out※	$\overline{\text{SIGNAL OUT3}}$	Initial value: Y axis DFLINT (can be switched to any other axis and output signal)	
15	—	GND	GND(internal +5 V GND)	
16	Out	+5V	Internal +5 V	
17	—	NC	Reserved	
18	—	NC	Reserved	
19	—	NC	Reserved	
20	—	GND	GND(internal +5 V GND)	

● A signal marked with ※ can be switched.
An underline indicates the initial value after the relevant signal is reset.

● $\overline{\text{MAN}}$, $\overline{\text{CWMS}}$, and $\overline{\text{CCWMS}}$ signals are fixed to active and cannot be changed.

For the functions of these signals, refer to the following:
Section 8-9, "MANUAL SCAN Drive
Section 8-11, "Using External Signal Functions"

Note 1: When the $\overline{\text{MAN}}$ signal goes low, the functions of the PAUSE, SS0, SS1, and SLSTOP signals assigned to the SIGNAL IN signal are invalid.

(3) Board edge connector (CN1)

Pin No.	Signal name	Pin No.	Signal name	Pin No.	Signal name	Pin No.	Signal name
A1	~~TRST#~~	A32	AD[16]	B1	- ~~12V~~	B32	AD[17]
A2	~~+12V~~	A33	+3.3V	B2	~~TCK~~	B33	C/BE[2]#
A3	~~TMS~~	A34	FRAME#	B3	GND	B34	GND
A4	TDI	A35	GND	B4	TDO	B35	IRDY#
A5	+5V	A36	TRDY#	B5	+5V	B36	+3.3V
A6	INTA#	A37	GND	B6	+5V	B37	DEVSEL#
A7	~~INTC#~~	A38	STOP#	B7	~~INTB#~~	B38	GND
A8	+5V	A39	+3.3V	B8	~~INTD#~~	B39	LOCK#
A9	~~Reserved~~	A40	~~Reserved~~	B9	PRSNT1#	B40	PERR#
A10	V(I/O)	A41	~~Reserved~~	B10	~~Reserved~~	B41	+3.3V
A11	~~Reserved~~	A42	GND	B11	PRSNT2#	B42	SERR#
A12	Key	A43	PAR	B12	Key	B43	+3.3V
A13	Key	A44	AD[15]	B13	Key	B44	C/BE[1]#
A14	~~3.3Vaux~~	A45	+3.3V	B14	~~Reserved~~	B45	AD[14]
A15	RST#	A46	AD[13]	B15	GND	B46	GND
A16	V(I/O)	A47	AD[11]	B16	CLK	B47	AD[12]
A17	~~GNT#~~	A48	GND	B17	GND	B48	AD[10]
A18	GND	A49	AD[09]	B18	~~REQ#~~	B49	M66EN
A19	~~PME#~~	A50	Key	B19	V(I/O)	B50	Key
A20	AD[30]	A51	Key	B20	AD[31]	B51	Key
A21	+3.3V	A52	C/BE[0]#	B21	AD[29]	B52	AD[08]
A22	AD[28]	A53	+3.3V	B22	GND	B53	AD[07]
A23	AD[26]	A54	AD[06]	B23	AD[27]	B54	+3.3V
A24	GND	A55	AD[04]	B24	AD[25]	B55	AD[05]
A25	AD[24]	A56	GND	B25	+3.3V	B56	AD[03]
A26	IDSEL	A57	AD[02]	B26	C/BE[3]#	B57	GND
A27	+3.3V	A58	AD[00]	B27	AD[23]	B58	AD[01]
A28	AD[22]	A59	V(I/O)	B28	GND	B59	V(I/O)
A29	AD[20]	A60	~~REQ64#~~	B29	AD[21]	B60	~~ACK64#~~
A30	GND	A61	+5V	B30	AD[19]	B61	+5V
A31	AD[18]	A62	+5V	B31	+3.3V	B62	+5V

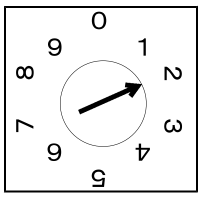
◆ The signals crossed out by lines are not connected on this board.

3．SETTING

Before integrating the C-V870 into the PC, set the switches and jumper connectors on the board.

3-1. Setting the Board Number (S1)

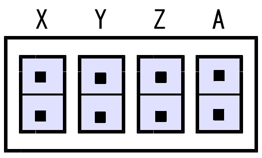
Assign a board number to the C-V870 using the rotary switch S1 on the board.
When one C-V870 is used, set the rotary switch to 0 (default setting before shipment).
When two or more C-V870 boards are used, assign board numbers to the second and any subsequent boards in such a way that no numbers are duplicated.
The following figure shows an example in which board number 2 is assigned.



◆ The S1 setting is validated after power-on.
Set the switch with power off, and turn it on after changing the setting.

3-2. Setting the Initial Specifications of Drive Parameters (JP1)

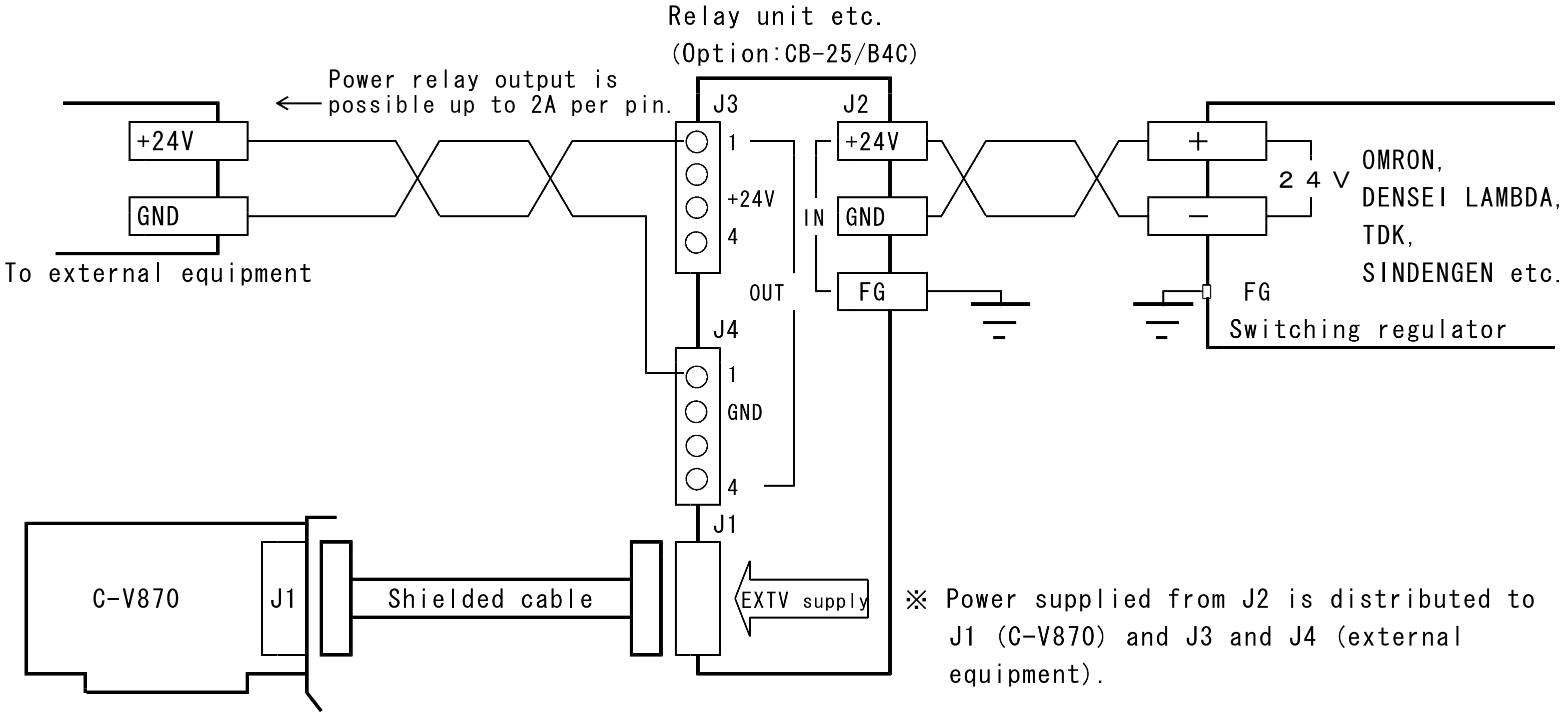
Jumper connector JP1 on the board can be used to set the initial values of drive parameters for each axis. MANUAL SCAN drive works based on the initial values selected by JP1 after resetting or based on the current parameter values. Select initial values when performing MANUAL SCAN drive through the J2 connector.



Drive parameter	Initial value of each axis	
	JP1 connected	JP1 disconnected
LSPD	300 Hz	800 Hz
HSPD	3,000 Hz	10,000 Hz
ELSPD	300 Hz	800 Hz
URATE	No. H'18 (100 ms/kHz)	No. H'25 (30 ms/kHz)
DRATE	No. H'18 (100 ms/kHz)	No. H'25 (30 ms/kHz)
END PULSE	0 pulse	0 pulse
ESPD	300 Hz	800 Hz
ESPD DELAY TIME	H'0000 (continuous)	H'0000 (continuous)
SLSPD	300 Hz	800 Hz
SHSPD	3,000 Hz	10,000 Hz
SELSPD	300 Hz	800 Hz
SURATE	No. H'18 (100 ms/kHz)	No. H'25 (30 ms/kHz)
SDRATE	No. H'18 (100 ms/kHz)	No. H'25 (30 ms/kHz)
SCAREA1	H'0014 (1,000 Hz)	H'003C (3,000 Hz)
SCAREA2	H'0014 (1,000 Hz)	H'003C (3,000 Hz)
SCAREA3	H'0014 (1,000 Hz)	H'003C (3,000 Hz)
SCAREA4	H'0014 (1,000 Hz)	H'003C (3,000 Hz)
SEND PULSE	0 pulse	0 pulse
SESPD	300 Hz	800 Hz
SESPD DELAY TIME	H'0000 (continuous)	H'0000 (continuous)
ORIGIN CSPD	300 Hz	800 Hz

４．ＣＯＮＮＥＣＴＩＯＮ

4-1. Example of Interface Power Supply Connection

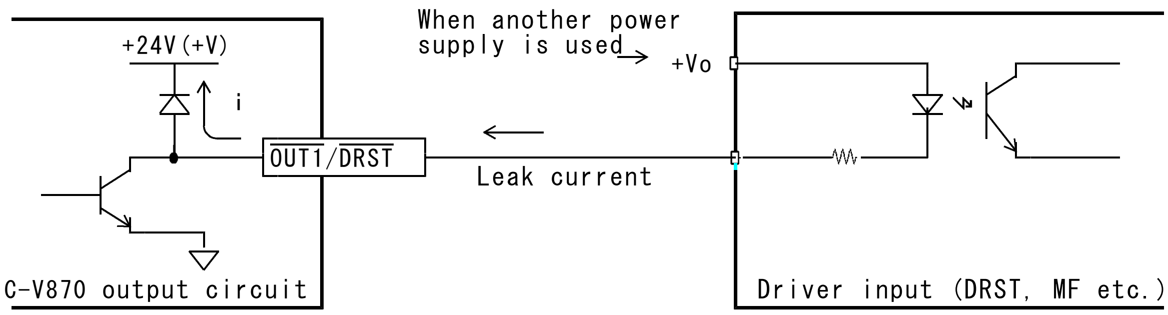


※ Power supplied from J2 is distributed to J1 (C-V870) and J3 and J4 (external equipment).

・For the external interface power supply (EXTV) of controller C-V870, connect +24 VDC from the common power supply so that it turns on and off in synchronization with externally connected equipment.
For easy connection, use the optional relay unit.

・For the power supply used for the driver interface, use one prepared by the C-V870, such as DRSTCOM. For details, refer to Section 4-2, "Examples of Connection to Drivers."

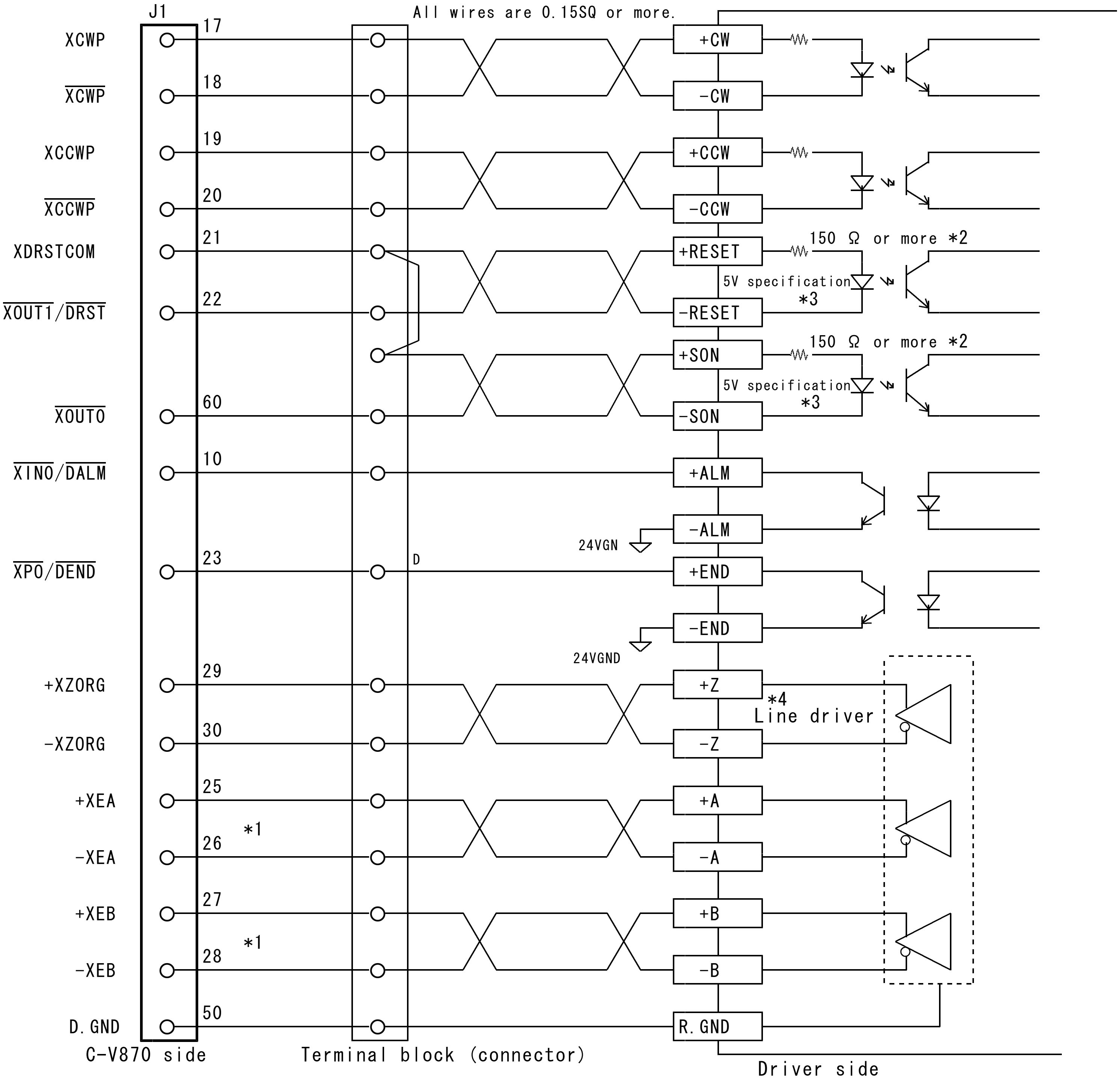
◆ Power may be supplied to the driver from a power supply different from the C-V870 such as by connecting to the DRST signal of the servo driver or motor free (MF) signal of the stepping driver. If so and power supply to the driver (+Vo) is greater than power supply to the C-V870 (+V), leak current i flows through the protection diode of the output circuit and the input circuit of the connection destination may be put in the ON state.



4-2. Examples of Connection to Drivers

(1) Example of connection to the servo motor driver

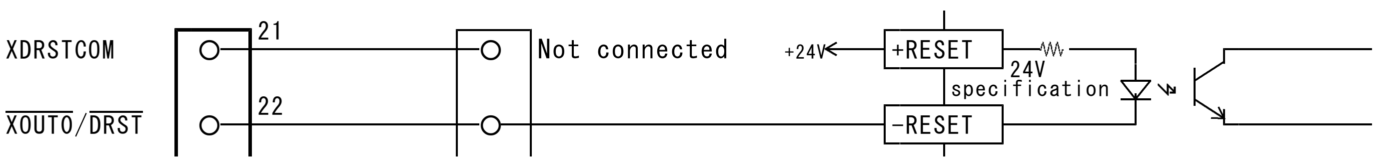
X axis pin numbers are used in this example.



*1 This signal is required when counting encoder feedback pulses.

*2 If the current limiting resistor on the driver side is less than 150 Ω, externally add resistor so that the total resistor value becomes 150 Ω or more.

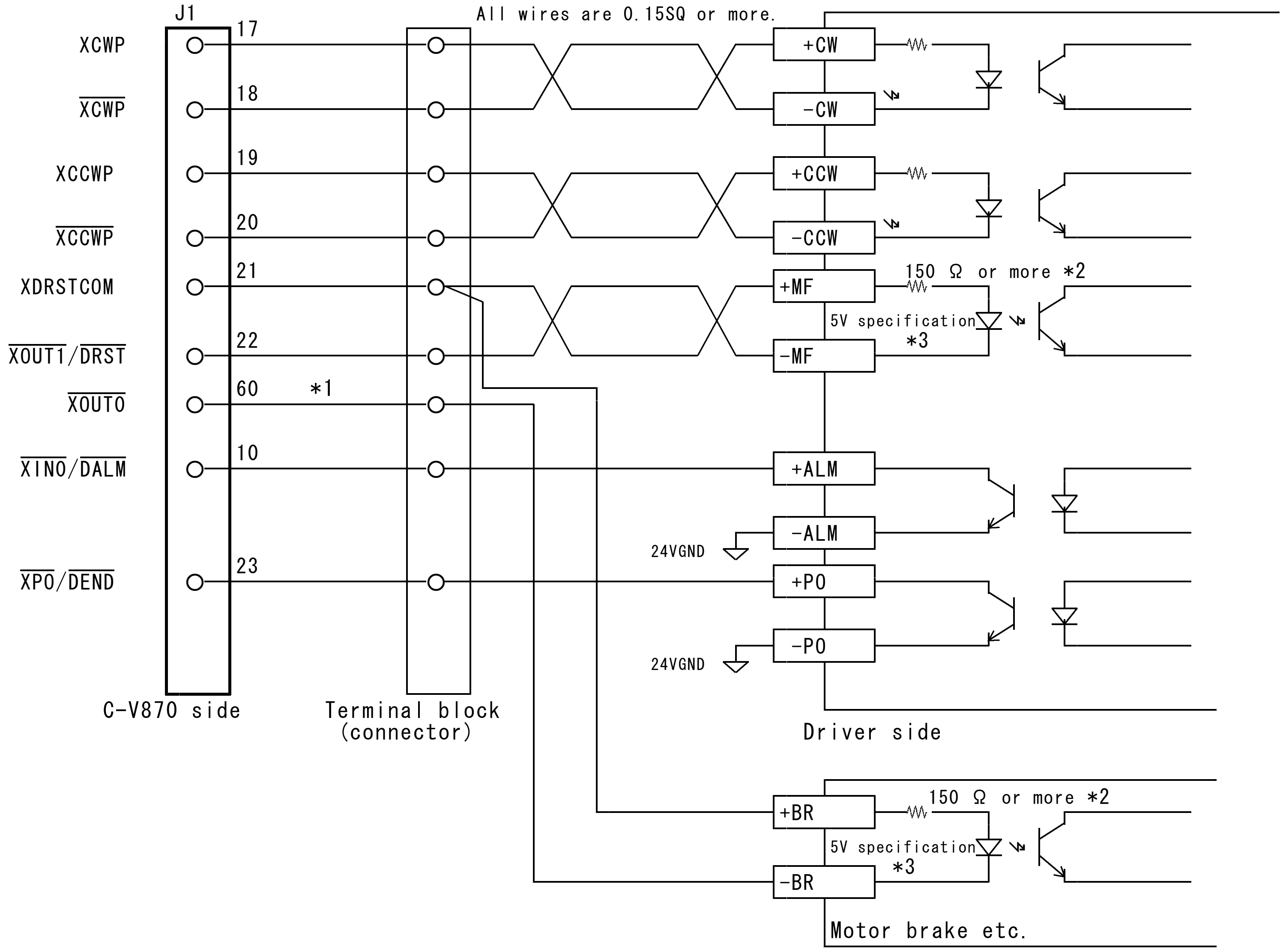
*3 When the counter RESET input circuit of the servo driver uses a +24 V interface
The handling of the servo-on signal is the same.



*4 Use a servo driver for which the encoder uses line driver output.

(2) Example of connection to the stepping motor driver

X axis pin numbers are used in this example.



*1 OUT0 signal can be used as constant general-purpose output.

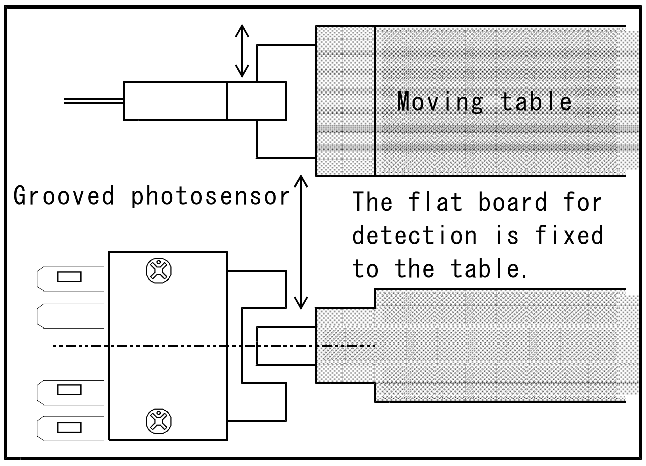
*2 If the current limiting resistor on the driver side is less than 150 Ω, externally add resistor so that the total resistor value becomes 150 Ω or more.

*3 When the input circuit uses a +24 V interface

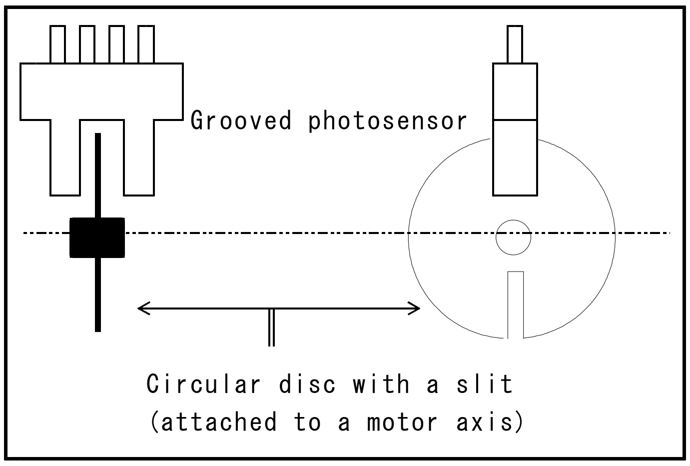
4-3. Examples of Connection to Sensors

(1) Example of sensor attachment (photosensor)

【Linear sensors (ORG, NORG, LIMIT)】



【Rotary sensor (ORG)】

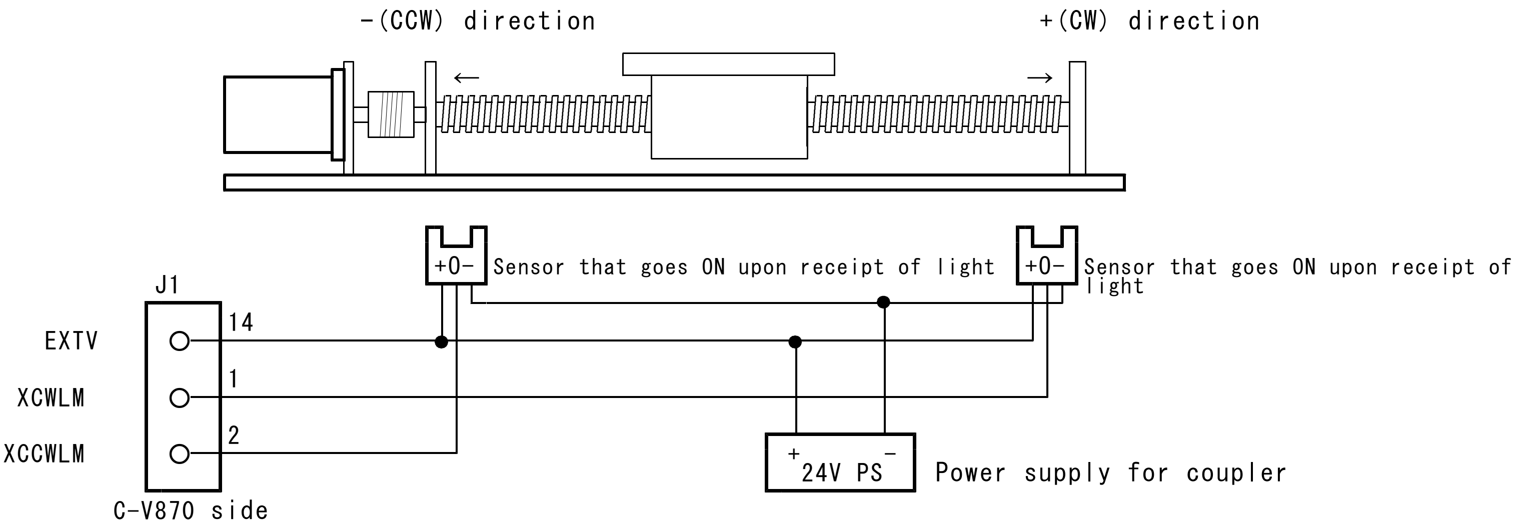


● Example of recommended sensors

Sensor that goes OFF upon receipt of light		Sensor that goes ON upon receipt of light	
Maker	Rating	Maker	Rating
SUNX	PM-K53	SUNX	PM-K53B
	PM-L53		PM-L53B
	PM-T53		PM-T53B
OMRON	EE-SPX301	OMRON	EE-SPX401
	EE-SX670A		EE-SX670A

(2) Example of connection to a limit sensor

X axis pin numbers are used in this example.

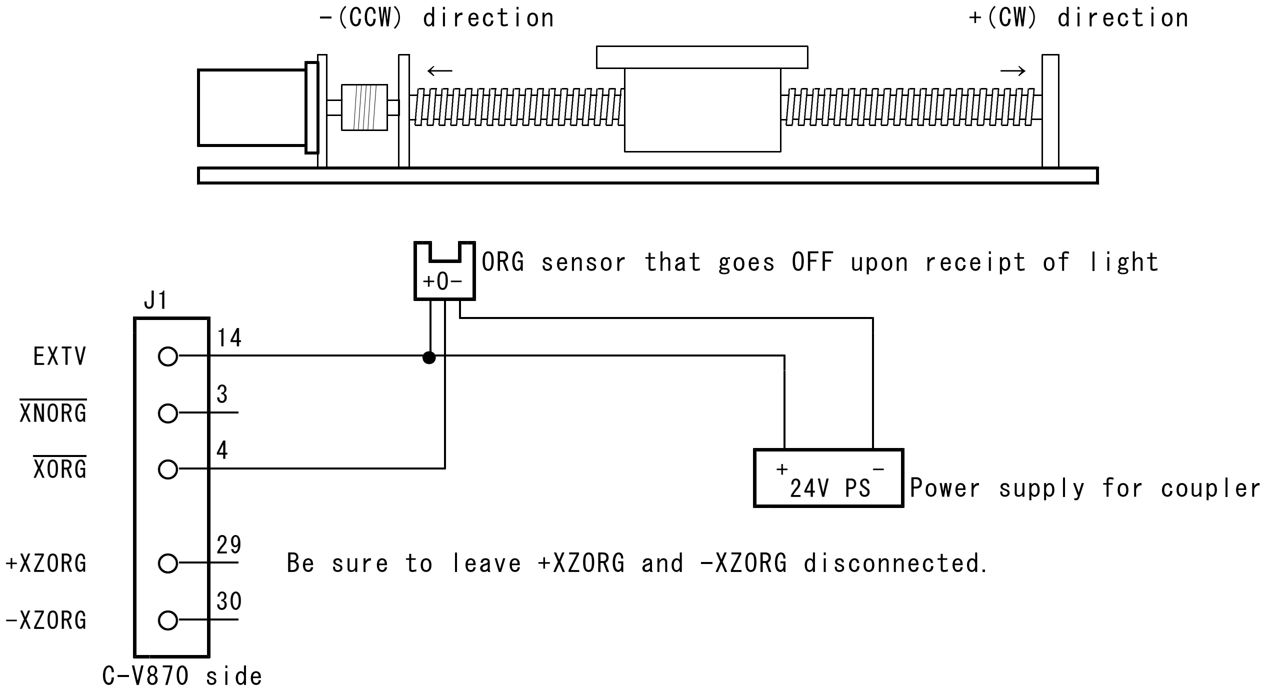


・The initial value of the limit signal is active-off (B contact) input.
Even when the limit signal is not used, the limit signal input must be connected to GND in order to output pulses.
＊ Input logic of the limit signal can be switched. For details, refer to separate manual "Technical Data A."

・The machine origin detection function using the LIMIT sensor can be used.
＊ For details, refer to section 8-6,"ORG-11 dirve type and ORG-12 dirve type".

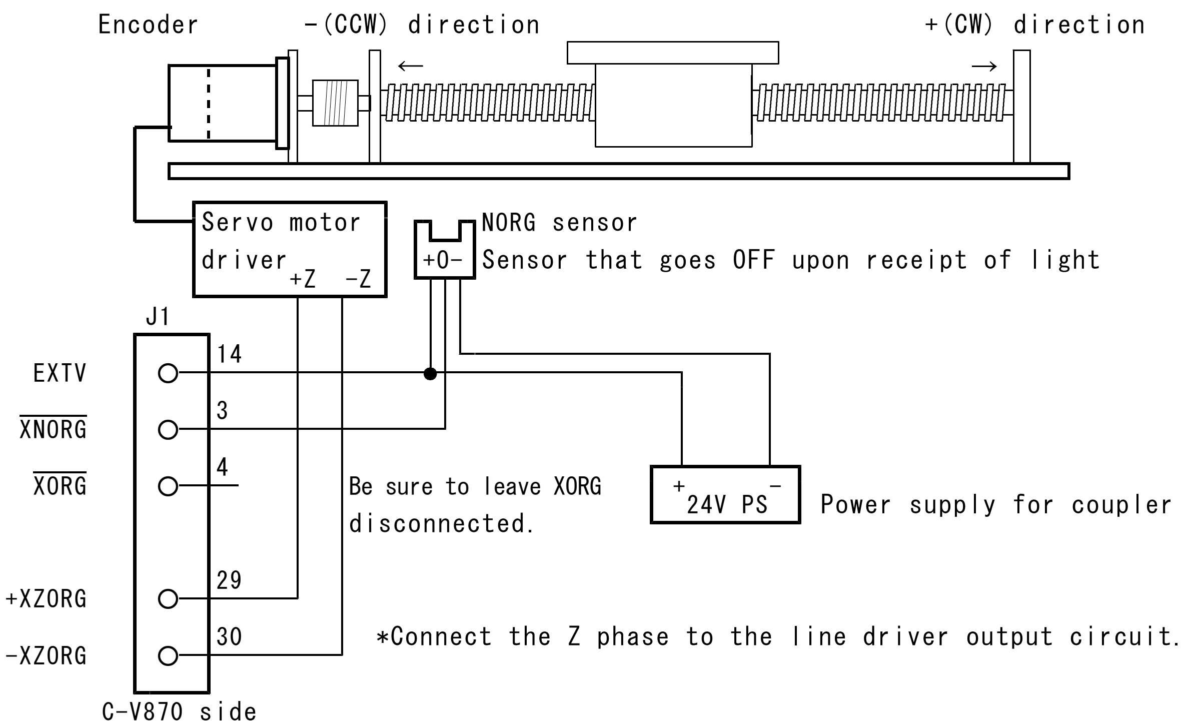
(3) Example of connection to an origin sensor
X axis pin numbers are used in this example.

■ When using the ORG-0, ORG-1, ORG-2, or ORG-3 type

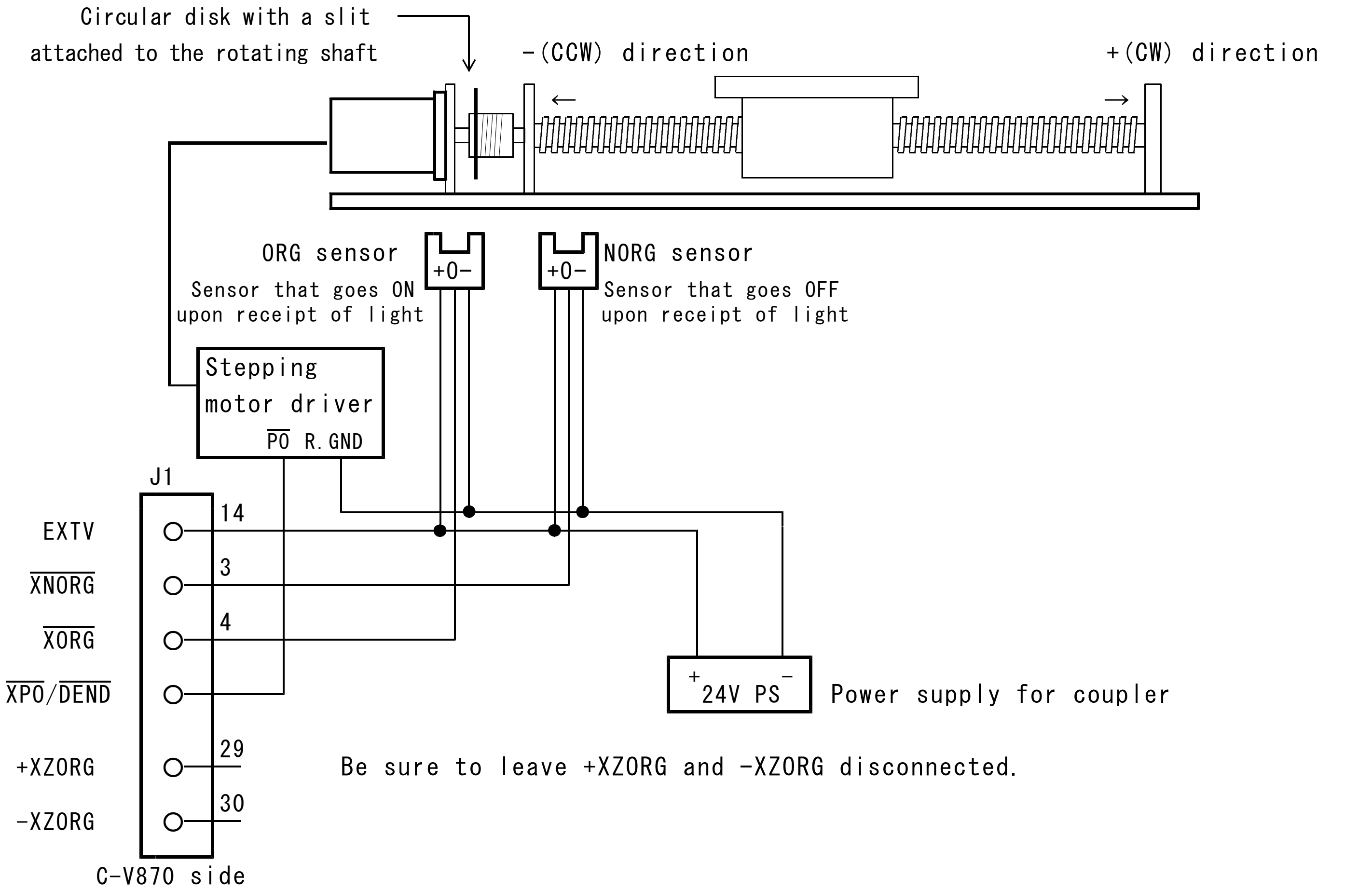


■ When using the ORG-4 or ORG-5 type

● Servo motor driver

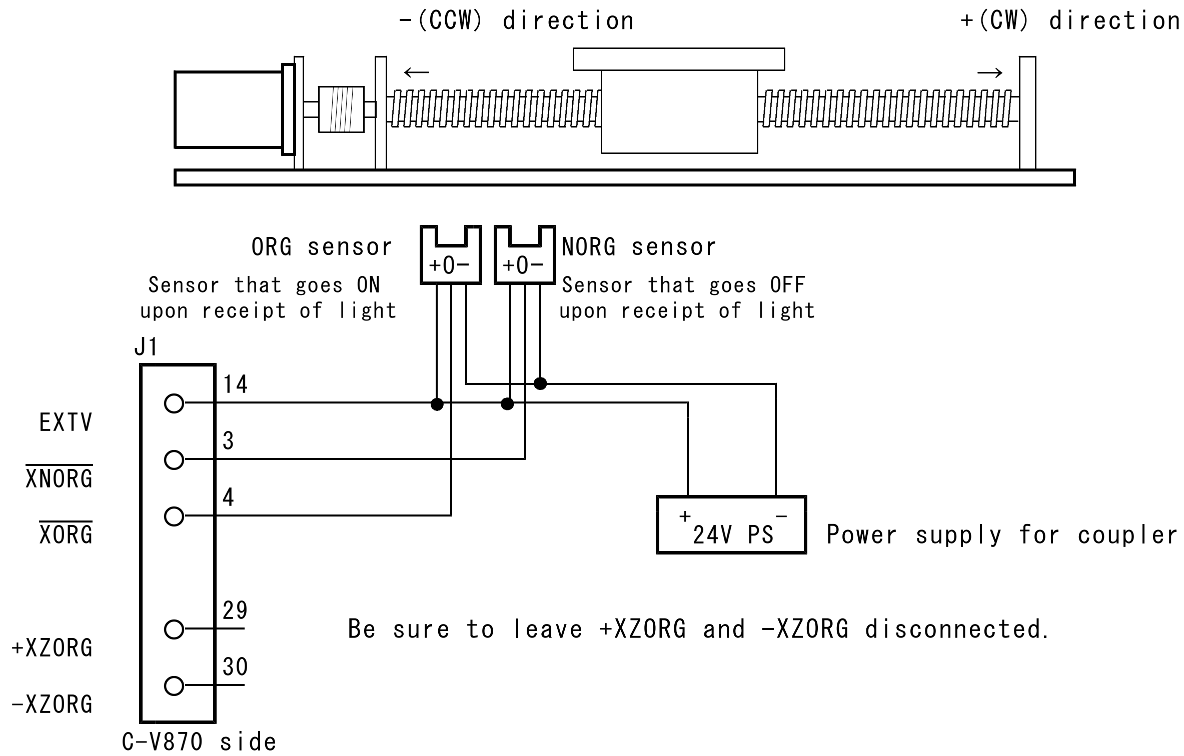


● Stepping motor driver



* To detect the ORG signal by the PO signal, use the ORIGIN SPEC SET command to set ORG TYPE as AND (conjunction) of the ORG and PO signals.
* To detect step-out, use the Z phase of the encoder signal instead of the PO signal. For details on the step-out detection function, refer to the separate manual "Technical Data A."

■ When using the ORG-10 type



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5-1. MCC06 Port

Axis name	Write: Low-order address	Write: Port name	Read: Low-order address	Read: Port name
X axis	H'00	DRIVE COMMAND PORT	H'00	STATUS1 PORT
	H'02	DRIVE DATA1 PORT	H'02	DRIVE DATA1 PORT
	H'04	DRIVE DATA2 PORT	H'04	DRIVE DATA2 PORT
	H'06	DRIVE DATA3 PORT	H'06	DRIVE DATA3 PORT
	H'08	COUNTER COMMAND PORT	H'08	STATUS2 PORT
	H'0A	COUNTER DATA1 PORT	H'0A	STATUS3 PORT
	H'0C	COUNTER DATA2 PORT	H'0C	STATUS4 PORT
	H'0E	COUNTER DATA3 PORT	H'0E	STATUS5 PORT
Y axis	H'10	DRIVE COMMAND PORT	H'10	STATUS1 PORT
	H'12	DRIVE DATA1 PORT	H'12	DRIVE DATA1 PORT
	H'14	DRIVE DATA2 PORT	H'14	DRIVE DATA2 PORT
	H'16	DRIVE DATA3 PORT	H'16	DRIVE DATA3 PORT
	H'18	COUNTER COMMAND PORT	H'18	STATUS2 PORT
	H'1A	COUNTER DATA1 PORT	H'1A	STATUS3 PORT
	H'1C	COUNTER DATA2 PORT	H'1C	STATUS4 PORT
	H'1E	COUNTER DATA3 PORT	H'1E	STATUS5 PORT
Z axis	H'20	DRIVE COMMAND PORT	H'20	STATUS1 PORT
	H'22	DRIVE DATA1 PORT	H'22	DRIVE DATA1 PORT
	H'24	DRIVE DATA2 PORT	H'24	DRIVE DATA2 PORT
	H'26	DRIVE DATA3 PORT	H'26	DRIVE DATA3 PORT
	H'28	COUNTER COMMAND PORT	H'28	STATUS2 PORT
	H'2A	COUNTER DATA1 PORT	H'2A	STATUS3 PORT
	H'2C	COUNTER DATA2 PORT	H'2C	STATUS4 PORT
	H'2E	COUNTER DATA3 PORT	H'2E	STATUS5 PORT
A axis	H'30	DRIVE COMMAND PORT	H'30	STATUS1 PORT
	H'32	DRIVE DATA1 PORT	H'32	DRIVE DATA1 PORT
	H'34	DRIVE DATA2 PORT	H'34	DRIVE DATA2 PORT
	H'36	DRIVE DATA3 PORT	H'36	DRIVE DATA3 PORT
	H'38	COUNTER COMMAND PORT	H'38	STATUS2 PORT
	H'3A	COUNTER DATA1 PORT	H'3A	STATUS3 PORT
	H'3C	COUNTER DATA2 PORT	H'3C	STATUS4 PORT
	H'3E	COUNTER DATA3 PORT	H'3E	STATUS5 PORT

5-2. HENSA Port

Axis name	Write: Low-order address	Write: Port name	Read: Low-order address	Read: Port name
X axis	H'40	HENSA COMMAND PORT	H'40	HENSA STATUS1 PORT
	H'42	HENSA DATA1 PORT	H'42	HENSA DATA1 PORT
	H'44	HENSA DATA2 PORT	H'44	HENSA DATA2 PORT
	H'46	Reserved	H'46	Reserved
Y axis	H'48	HENSA COMMAND PORT	H'48	HENSA STATUS1 PORT
	H'4A	HENSA DATA1 PORT	H'4A	HENSA DATA1 PORT
	H'4C	HENSA DATA2 PORT	H'4C	HENSA DATA2 PORT
	H'4E	Reserved	H'4E	Reserved
Z axis	H'50	HENSA COMMAND PORT	H'50	HENSA STATUS1 PORT
	H'52	HENSA DATA1 PORT	H'52	HENSA DATA1 PORT
	H'54	HENSA DATA2 PORT	H'54	HENSA DATA2 PORT
	H'56	Reserved	H'56	Reserved
A axis	H'58	HENSA COMMAND PORT	H'58	HENSA STATUS1 PORT
	H'5A	HENSA DATA1 PORT	H'5A	HENSA DATA1 PORT
	H'5C	HENSA DATA2 PORT	H'5C	HENSA DATA2 PORT
	H'5E	Reserved	H'5E	Reserved

5-3. HARD CONFIGURATION Port

Axis name	Write: Low-order address	Write: Port name	Read: Low-order address	Read: Port name
—	H'E0	HARD CONFIG COMMAND PORT	H'E0	SIGNAL STATUS PORT
	H'E2	HARD CONFIG DATA1 PORT	H'E2	HARD CONFIG DATA1 PORT
	H'E4	HARD CONFIG DATA2 PORT	H'E4	HARD CONFIG DATA2 PORT
	H'E6	HARD CONFIG DATA3 PORT	H'E6	HARD CONFIG DATA3 PORT
	H'E8	Reserved	H'E8	Reserved
	H'EA	Reserved	H'EA	Reserved
	H'EC	Reserved	H'EC	Reserved
	H'EE	Reserved	H'EE	Reserved

6. DESCRIPTION OF PORT

6-1. MCC06 Port

(1) DRIVE COMMAND port

Writing a DRIVE command to this port sets data or executes the specified drive. DRIVE commands are classified into general-purpose commands and special commands.

- ◆ A general-purpose command can be written when STATUS1 PORT BUSY is 0.
  If the command reservation function is enabled, a general-purpose command can be written as a reserved command when STATUS5 PORT COMREG FL is 0 even when BUSY is 1. Note, however, that the writing is disabled if STATUS1 PORT MAN is 1.
- ◆ Drive CHANGE commands (H'F030 to H'F03F) of special commands can be written when STATUS1 PORT SPEED CBUSY is 0 or INDEX CBUSY is 0.
- ◆ The other special commands can be written any time.
- * For the command reservation function, refer to the separate manual "Technical Data A."

(2) DRIVE DATA1, 2, 3, PORTs (write)

Setting data of DRIVE commands or operation data of the specified drive is written to these ports.
Writing to these ports is always enabled.

(3) COUNTER COMMAND PORT

Writing a COUNTER command to this port sets data.
Writing a COUNTER command is always enabled.

- ◆ Note, however, that the following COUNTER commands can be written only when BUSY is 0:
  - ・ADDRESS COUNTER PRESET
  - ・ADDRESS COUNTER MAX COUNT SET
- ◆ The other COUNTER commands can be written any time.

(4) COUNTER DATA1, 2, 3 PORTs (write)

Setting data of COUNTER commands is written to these ports.
Writing to these ports is always enabled.

(5) STATUS1 PORT

STATUS1 PORT is used to display the current status of bus control. Reading this port is always enabled.

D15	D14	D13	D12	D11	D10	D9	D8
PAUSE	MAN	INDEX CBUSY	SPEED CBUSY	EXT PULSE	CONST	DOWN	UP

D7	D6	D5	D4	D3	D2	D1	D0
FSEND	SSEND	LSEND	ERROR	DRVEND	DRIVE	STBY	BUSY

(shaded) Applied functions
Refer to the separate manual "Technical Data A."

＊Each of these bits becomes 1 in the active state.

D0 : BUSY

Indicates whether command data processing or driving is in progress.

1 : Indicates command data processing or driving is in progress.

0 : Indicates command input wait status.

◆ XBUSY = 1 and YBUSY = 1 during execution of a 2-axis interpolation command.

◆ The following commands are written when BUSY = 0 and STATUS1 PORT MAN = 0:

・General-purpose command

・ADDRESS COUNTER PRESET command of COUNTER COMMAND

・ADDRESS COUNTER MAX COUNT SET command of COUNTER COMMAND

◆ If the command reservation function is enabled, general-purpose commands can be written even when BUSY = 1.

＊ For the command reservation function, refer to the separate manual "Technical Data A."

D1 : STBY

Indicates that preparation for pulse output (parameter processing) is complete.

1 : Indicates that the preparation for pulse output is complete.

0 : This bit is cleared upon detection of the active state of the STBY cancel condition that was set by the STBY SPEC SET command. Or, the bit is cleared upon detection of the active state of the immediate stop command.

◆ During execution of a 2-axis interpolation command, both XSTBY and YSTBY are reset to 0 upon detection of the STBY cancel condition that was set by the STBY SPEC SET command for the X axis (main axis).

◆ When the axis is stopped after execution of interpolation drive, the STBY flag of the main axis temporarily becomes 1. The STBY flag becomes 1 when the interpolation drive is finished or reset to 0 when the next pulse output begins.

D2 : DRIVE

Indicates whether pulse output is in progress.

1 : Indicates that pulse output is in progress.

0 : Indicates that pulse output is stopped.

D3 : DRVEND

Indicates that the execution of a general-purpose command involving pulse output is finished.

1 : Indicates that the execution of a general-purpose command involving pulse output is finished.

0 : This bit is cleared when the next general-purpose command is executed.

◆ Executing MANUAL SCAN drive also clears the bit.

◆ DRVEND is also set to 1 when a general-purpose command involving pulse output is executed without pulse output because of detection of a stop command or error occurrence.

◆ If the DEND or DRST signal is enabled by the SERVO SPEC SET command, DRVEND is set to 1 after detection of a driver completion signal.

D4 : ERROR

Indicates that an error occurred during data input, command input, or execution of various functions.

1 : Indicates that an error occurred.

0 : This bit is cleared when the next general-purpose command is executed.

◆ Executing MANUAL SCAN drive also clears the bit.

◆ Details of an error can be checked with check command ERROR STATUS READ.

◆ If an error occurs in a 2-axis interpolation command, ERROR for the relevant axis is set to 1.

D5 : LSEND

Indicates that the active state of a LIMIT stop command has been detected.

1 : When STBY = 1 or DRIVE = 1, the active state of a LIMIT stop command has been detected.
When STBY = 0 and DRIVE = 0, the pulse output has been finished by a LIMIT stop command.

0 : This bit is cleared when the next general-purpose command involving pulse output is executed.

◆ Executing MANUAL SCAN drive also clears the bit.

◆ If LIMIT stop is performed during ORIGIN drive, the bit is cleared when the next process begins.

◆ If a LIMIT stop command is detected during 2-axis interpolation drive, XLSEND and YLSEND are both set to 1.

◆ LIMIT stop commands includes the CWLM and CCWLM signals for which the input function is set for LIMIT slow stop or LIMIT immediate stop, and SOFT LIMIT position stop by the SOFT LIMIT function.

＊ For the SOFT LIMIT function, refer to the separate manual "Technical Data A."

D6 : **SSEND**

Indicates that the active state of a slow stop command has been detected.

1 : When STBY = 1 or DRIVE = 1, the active state of a slow stop command has been detected.
When STBY = 0 and DRIVE = 0, pulse output has been terminated by a slow stop command.

0 : This bit is cleared when the next general-purpose command involving pulse output is executed.

◆ Executing MANUAL SCAN drive also clears the bit.

◆ If a slow stop command is detected during 2-axis interpolation drive, XSSEND and YSSEND are both set to 1. Slow stop commands includes the SLOW STOP command, CWLM and CCWLM that have been set for LIMIT slow stop, SS0, SS1, and DALM signals that have been set for slow stop, comparator output of each counter for which the stop function has been set for slow stop, and SLSTOP signal assigned by HARD CONFIGURATION.

D7 : **FSEND**

Indicates that an active state of an immediate stop command has been detected.

1 : When DRIVE = 1, this bit indicates that an active state of an immediate stop command has been detected.
When DRIVE = 0, this bit indicates that drive has been forcibly terminated by an immediate stop command.

0 : This bit is cleared when the next general-purpose command involving pulse output is executed.

◆ Executing MANUAL SCAN drive also clears the bit.

◆ If an immediate stop command is detected during 2-axis interpolation drive, XFSEND and YFSEND are both set to 1.

◆ The data setting command being executed is not forcibly terminated even if an immediate stop command is detected.
Immediate stop commands include the FFSTOP1 signal, FFSTOP2 signal, FAST STOP command, CWLM and CCWLM signals that have been set for LIMIT immediate stop, SS0, SS1, and DALM signals that have been set for immediate stop, and comparator output of each counter for which the stop function has been set for immediate stop.

D8 : **UP**

Indicates whether the speed of the drive pulses being output is being accelerated.

1 : Accelerating, or executing the first step of each type of drive.

0 : Decelerating, driving at constant speeds, or stopped.

◆ UP is set to 1 for the first step of execution of each type of drive (first gear shift cycle).

D9 : **DOWN**

Indicates whether the speed of the drive pulses being output is being decelerated.

1 : Decelerating

0 : Accelerating, driving at constant speeds, or stopped.

D10 : **CONST**

Indicates whether drive pulses are output at constant speeds.

1 : Driving at constant speeds.

0 : Accelerating, decelerating, or stopped.

◆ During 2-axis interpolation drive, the UP, DOWN, and CONST flags of only the X axis (main axis) are valid.

D11 : **EXT PULSE**

Indicates that drive pulses be output as encoder signals or external pulses.

1 : Pulses are output as encoder signals or pulses generated by other axes.

0 : Pulses are output as those generated by the local axis.

◆ Use the ADDRESS COUNTER INITIALIZE1 command to set external pulse output from encoder signals.

◆ When EXT PULSE = 1, the following STATUS1 PORT flags are valid:BUSY, STBY, DRIVE, ERROR, LSEND, FSEND.

◆ The general-purpose command write, synchronous start, and servo drive functions are disabled.

◆ EXT PULSE can be stopped while input signals are ON when the FSSTOP1, FSSTOP2, SS0, or SS1 signal is set for immediate stop. Upon cancellation of this stop signal, pulse output from EXT PULSE begins.

D12 : **SPEED CBUSY** (applied function)

Indicates that a speed-oriented drive CHANGE command is being processed or the inputs of speed-oriented drive CHANGE commands are invalid.

1 : A speed-oriented drive CHANGE command or a drive CHANGE signal is being processed. Or, the inputs of speed-oriented drive CHANGE commands are invalid.

0 : Waiting for input of a speed-oriented drive CHANGE command or a drive CHANGE signal.

◆ A speed-oriented drive CHANGE command is executed after SPEED CBUSY = 0 is confirmed. Speed-oriented drive CHANGE commands include UP DRIVE, DOWN DRIVE, CONST DRIVE, SPEED CHANGE, and RATE CHANGE.

◆ Input of a drive CHANGE command is invalid while SPEED CBUSY = 1.
Drive CHANGE signals include SS0 and SS1 for which the input function is set for the UP, DOWN, and CONST DRIVE command signals.

* For the drive CHANGE function, refer to the separate manual "Technical Data A."

D13 : INDEX CBUSY (applied function)

Indicates that an INDEX CHANGE command is being processed or the inputs of INDEX CHANGE commands are invalid.

1 : An INDEX CHANGE command is being processed.
Or, the inputs of INDEX CHANGE commands are invalid.

0 : Waiting for input of an INDEX CHANGE command

◆ An INDEX CHANGE command is executed after INDEX CBUSY = 0 is confirmed.
INDEX CHANGE commands include INC INDEX CHANGE, ABS INDEX CHANGE, and PLS INDEX CHANGE.

＊For the INDEX CHANGE function, refer to the separate manual "Technical Data A."

D14 : MAN

Indicates whether MANUAL SCAN drive can be started.

1 : MANUAL SCAN drive can be started.

0 : MANUAL SCAN drive cannot be started.

◆ When the MAN signal of the J2 connector goes low while BUSY = 0, MAN is set to 1. MAN is set to 0 when the MAN signal of the J2 connector goes high.

◆ When MAN =1, you can operate the CWMS or CCWMS signals to start MANUAL SCAN drive.

◆ When MAN = 1, writing the following commands is invalid:

・General-purpose command
・ADDRESS COUNTER PRESET command of COUNTER COMMAND
・ADDRESS COUNTER MAX COUNT SET command of COUNTER COMMAND

D15 : PAUSE

Indicates that the function for holding STBY = 1 by the PAUSE signal is enabled.

1 : The function for holding STBY = 1 is enabled.

0 : The function for holding STBY = 1 is disabled.

◆ Turning on the PAUSE signal sets PAUSE to 1.
Turning off the PAUSE signal sets PAUSE to 0.
Use the HARD CONFIGURATION command to make settings for turning on or off the PAUSE signal.

◆ When PAUSE = 1, the status at STBY = 1 is retained and the start of drive pulse output is suspended.

◆ The PAUSE signal and PAUSE flag are enabled when drive starts as follows:

・Command that involves pulse output
・Execution of a command that involves pulse output during continuous drive by the command reservation function

◆ The PAUSE flag is masked to 0 at one of the following pauses caused during continuous drive:
The PAUSE signal and the synchronous start function are disabled.

・Pause caused before shifting to each processing of ORIGIN drive
・Pause caused before executing END PULSE drive
・Pause caused before executing end-point correcting drive during circular interpolation drive
・Pause caused before executing reverse drive by the INDEX CHANGE command
・Pause caused after the JOG process of MANUAL SCAN drive

◆ For the interpolation drive, only the PAUSE signal and PAUSE flag of the main axis are valid.
The PAUSE signals and PAUSE flags of sub-axes are invalid.

＊For the command reservation function, refer to the separate manual "Technical Data A."

(6) STATUS2 PORT

STATUS2 PORT is used to display the current status of the stop function, ORIGIN function, and servo support function. Reading this port is always enabled.

D15	D14	D13	D12	D11	D10	D9	D8
DEND BUSY	DALM	DEND	DRST	ORIGIN FLG	PO/Z phase	NORG	ORG

D7	D6	D5	D4	D3	D2	D1	D0
CCW SOFT LIMIT	CW SOFT LIMIT	FSSTOP2	FSSTOP2	CCWLM	CWLM	FSSTOP1	SLSTOP

[shaded] Applied functions
Refer to the separate manual "Technical Data A."

＊Each of these bits becomes 1 in the active state.

D0 : SLSTOP

Indicates the current active status of the SLSTOP signal.

1 : Active level input in progress

◆ This bit is valid when it is assigned to the SLSTOP signal using the HARD CONFIGURATION command.

D1 : FSSTOP1

Indicates the current active status of the FSSTOP1 signal (J1 connector signal).

1 : Active level input in progress

D2 : CWLM

Indicates the current active status of the CWLM signal (B-contact input).

1 : Active level input in progress

D3 : CCWLM

Indicates the current active status of the CCWLM signal (B-contact input).

1 : Active level input in progress

D4,D5 : FSSTOP2

Indicates the current active status of the FSSTOP2 signal (J2 connector signal).

1 : Active level input in progress

D6 : CW SOFT LIMIT (applied function)

Indicates the current active status of the CW SOFT LIMIT function.

1 : Pulse output is stopped at the CW SOFT LIMIT address by the SOFT LIMIT function.

0 : This bit is cleared when the next general-purpose command involving pulse output is executed.

◆ Executing MANUAL SCAN drive also clears the bit.

◆ This bit is valid when SOFT LIMIT ENABLE is set to 1 by the SPEC INITIALIZE3 command.

◆ If the DEND or DRST signal is enabled by the SERVO SPEC SET command, the SOFT LIMIT active status is displayed after the servo support function is complete.

◆ If the SOFT LIMIT address is detected during execution of 2-axis interpolation drive, both of the two axes stop at the SOFT LIMIT address of the detected axis. The SOFT LIMIT flag changes only for the axis at which SOFT LIMIT is detected.

D7 : CCW SOFT LIMIT (applied function)

Indicates the current active status of the CCW SOFT LIMIT function.

1 : Pulse output is stopped at the CCW SOFT LIMIT address by the SOFT LIMIT function.

0 : This bit is cleared when the next general-purpose command involving pulse output is executed.

◆ This bit is valid when SOFT LIMIT ENABLE is set to 1 by the SPEC INITIALIZE3 command.

◆ If the DEND or DRST signal is enabled by the SERVO SPEC SET command, the SOFT LIMIT active status is displayed after the servo support function is complete.

◆ If the SOFT LIMIT address is detected during execution of 2-axis interpolation drive, both of the two axes stop at the SOFT LIMIT address of the detected axis. The SOFT LIMIT flag changes only for the axis at which SOFT LIMIT is detected.

＊ For the SOFT LIMIT function, refer to the separate manual "Technical Data A."

D8 : ORG

Indicates the current active status of the ORG signal.

1 : Active level input in progress

D9 : NORG

Indicates the current active status of the NORG signal.

1 : Active level input in progress

D10 : PO/Z phase

Indicates the current active status of the PO signal or Z phase.

1 : Active level input in progress

◆ PO is valid when it is set for the stepping motor (open loop) using the HENSA INITIALIZE1 command. Z-phase is valid when it is set for step-out detection of the servo motor or stepping motor using the HENSA INITIALIZE1 command.

D11 : ORIGIN FLG

Indicates whether the machine origin address of the ORIGIN drive is recorded.

1 : The absolute address of the machine origin is recorded.

0 : The absolute address of the machine origin is not recorded.

D12 : DRST

Indicates the current output status of the DRST signal.

1 : High level output in progress (active level output in progress)

0 : Low level output in progress

D13 : DEND

Indicates the current active status of the DEND signal.

1 : Active level input in progress

D14 : DALM

Indicates the current active status of the DALM signal.

1 : Active level input in progress

D15 : DEND BUSY

Indicates that the system is waiting for detection of the active level of the DEND signal.

1 : Pulse output is complete and the system is waiting for detection of the active level of the DEND signal.

0 : This bit is cleared upon detection of the active level of the DEND signal.

◆ Either of the following types of forced end also clears the DEND BUSY bit:

・Forced end by the DEND ERROR function

・Detection of active status of an immediate stop command

◆ DEND BUSY = 1 indicates that drive is in execution.

◆ This bit is valid when the DEND signal is validated by the SERVO SPEC SET command.

(7) STATUS3 PORT

STATUS3 PORT is used to display the current status of interrupt request output and general-purpose input/output signals. Reading this port is always enabled.

D15	D14	D13	D12	D11	D10	D9	D8
GPIO7 (IN0)	Reserved (0)	Reserved (0)	Reserved (0)	Reserved (0)	Reserved (0)	GPIO1 (FSNED)	GPIO0 (ERROR)

Applied functions: Refer to the separate manual "Technical Data A."

D7	D6	D5	D4	D3	D2	D1	D0
OUT3 (SPDINT)	SIGNAL OUTB	SIGNAL OUTA	OUT0	INT3 (ERROR or FSEND)	INT2	INT1	INT0

＊Each of these bits becomes 1 in the active state.

D0 : INT0
D1 : INT1
D2 : INT2

Indicates the current output status of INT2 to INT0 signals.
- 1 : An interrupt is requested.
- 0 : No interrupt is requested.

◆ INT2-0 becomes "0" when individual interrupt requests are all cleared.
◆ These interrupt signals can be output to INTA# signals on the PCI bus.

D3 : INT3(ERROR or FSEND) (applied function)

Indicates the current output status of the INT3 signal (reserved command clearance factor). (Valid when the command reservation function is enabled)
- 1 : A factor for clearing the reserved command has been generated.
- 0 : A factor for clearing the reserved command has not been generated.

◆ Set this bit so that the reserved-command register is cleared by latch output of the INT3 signal.
- ・Use the INT FACTOR MASK command to cancel the GPIO0 and GPIO1 masks.
- ・When using "immediately stop upon output of a comparator match" of the pulse cycle counter, select Edge Latch for SPDINT TYPE of the SPEED COUNTER INITIALIZE1 command.

◆ Make assignment to the INT3 signal as follows:
- ・Use the HARD INITIALIZE2 command to assign the ERROR flag to GPIO0 and the FSEND flag to GPIO1.
- ・When using "immediately stop upon output of a comparator match" of the pulse cycle counter, assign SPDINT using OUT3 TYPE of the HARD INITIALIZE1 command.

◆ Use the INT FACTOR CLR command to clear the latch output of the INT3 signal (release the interlock).
＊ For the command reservation function, refer to the separate manual "Technical Data A."

D4 : OUT0

Indicates the current status of general-purpose output signal OUT0.
- 1 : Active level output in progress
- 0 : Non-active level output in progress

◆ For the general-purpose output signal output to the J1 connector, the default ADRINT signal is switched and used. The default ADRINT function is set so it outputs nothing.

D5 : SIGNAL OUTA (initial value: CNTINT)
D6 : SIGNAL OUTB (initial value: DFIINT)

Indicates the current output status of the SIGNAL OUTA and SIGNAL OUTB signals.
- 1 : Active level output in progress
- 0 : Non-active level output in progress

◆ These interrupt signals can be output as external signal outputs to the SIGNAL OUT3 to 0 signals.

D7 : OUT3(SPDINT) (applied function)
D8 : GPIO0(ERROR) (applied function)
D9 : GPIO1(FSEND) (applied function)

Indicates the current output status of the OUT3 (SPDINT), GPIO0 (ERROR), and GPIO1 (FSEND) signals.
- 1 : Active level output in progress
- 0 : Non-active level output in progress

◆ When the command reservation function is enabled, the signals assigned to INT3 and OUT3 are output. SPDINT is a latched signal. ERROR and FSEND are not latched but the signals latched from the INT3 signal can be checked.

D14--D10 : Reserved (0)

D15 : GPIO7(IN0) (applied function)

Indicates the current input status of the IN0 signal.
- 1 : Active level input in progress
- 0 : Non-active level input in progress

◆ When step-out is detected where the DALM signal is internally occupied, it can be read as a general-purpose input signal through this port.

(8) STATUS4 PORT

STATUS4 PORT is used to display the current status of counter overflow and counter comparator output. Reading this port is always enabled.

D15	D14	D13	D12	D11	D10	D9	D8
SPEED OVF	SPDINT COMP3	SPDINT COMP2	SPDINT COMP1	DFL OVF	DFLINT COMP3	DFLINT COMP2	DFLINT COMP1

＊Each of these bits becomes 1 in the active state.

D7	D6	D5	D4	D3	D2	D1	D0
PULSE OVF	CNTINT COMP3	CNTINT COMP2	CNTINT COMP1	ADDRESS OVF	ADRINT COMP3	ADRINT COMP2	ADRINT COMP1

D0 ：ADRINT COMP1
D1 ：ADRINT COMP2
D2 ：ADRINT COMP3

Indicates that the address counter value matches the detection condition of the COMPARE REGISTER (1, 2, or 3).
1 ：The address counter value matches the detection condition.
0 ：Entering the clearance condition clears the bit.
◆ Set the detection condition and clearance condition with ADDRESS COUNTER INITIALIZE 1 and 2 commands.

D3 ：ADDRESS OVF

Indicates that the address counter value has overflowed.
1 ：The address counter value has overflowed.
0 ：Executing the ADDRESS COUNTER PRESET command clears the bit.

D4 ：CNTINT COMP1
D5 ：CNTINT COMP2
D6 ：CNTINT COMP3

Indicates that the pulse counter value matches the detection condition of the COMPARE REGISTER (1, 2, or 3).
1 ：The pulse counter value matches the detection condition.
0 ：Entering the clearance condition clears the bit.
◆ Set the detection condition and clearance condition with PULSE COUNTER INITIALIZE 1 and 2 commands.

D7 ：PULSE OVF

Indicates that the pulse counter value has overflowed.
1 ：The pulse counter value has overflowed.
0 ：Executing the PULSE COUNTER PRESET command clears the bit.

D8 ：DFLINT COMP1
D9 ：DFLINT COMP2
D10 ：DFLINT COMP3

Indicates that the pulse differential counter value matches the detection condition of the COMPARE REGISTER (1, 2, or 3).
1 ：The pulse differential counter value matches the detection condition.
0 ：Entering the clearance condition clears the bit.
◆ Set the detection condition and clearance condition with DFL COUNTER INITIALIZE 1 and 2 commands.

D11 ：DFL OVF

Indicates that the pulse differential counter value has overflowed.
1 ：The pulse differential counter value has overflowed.
0 ：Executing the DFL COUNTER PRESET command clears the bit.

D12 ：SPDINT COMP1
D13 ：SPDINT COMP2
D14 ：SPDINT COMP3

Indicates that the count data of the pulse cycle counter, or counter latch data for SPDINT COMP2 or COMP3, matches the detection condition of the COMPARE REGISTER (1, 2, or 3).
1 ：The count data matches the detection condition.
0 ：Entering the clearance condition clears the bit.
◆ Set the detection condition and clearance condition with SPEED COUNTER INITIALIZE 1 and 2 commands. Use the SPEED COUNTER INITIALIZE3 command to set the data to be compared by COMP2 or COMP3.

D15 ：SPEED OVF

Indicates that the pulse cycle counter value has overflowed during measurement.
1 ：The pulse cycle counter has overflowed.
0 ：This bit is cleared by the input of the count timing of measured pulses, or by setting COUNT ENABLE TYPE to 000 using the SPEED COUNTER INITIALIZE3 command.

(9) STATUS5 PORT

STATUS5 PORT is used to display the current status of each input signal. Reading this port is always enabled.

D15	D14	D13	D12	D11	D10	D9	D8
X (undefined)	CPP MASK	INDEX CSET	SPEED CSET	CPPOUT	CPPIN	COMREG FL	COMREG EP

[ ] Applied functions
Refer to the separate manual "Technical Data A."

D7	D6	D5	D4	D3	D2	D1	D0
±YEB	±YEA	±XEB	±XEA	CCWMS	CWMS	SS1	SS0

*Each of these bits becomes 1 in the active state.

D0 : SS0
Indicates the current active status of the SS0 signal.
1 : Active level input in progress

D1 : SS1
Indicates the current active status of the SS1 signal.
1 : Active level input in progress

D2 : CWMS
Indicates the current active status of the CWMS signal.
1 : Active level input in progress

D3 : CCWMS
Indicates the current active status of the CCWMS signal.
1 : Active level input in progress

D4 : ±XEA
D5 : ±XEB
D6 : ±YEA
D7 : ±YEB
Indicates the current input status of the ± XEA, ± XEB,± YEA, and ± YEB signals.
1 : Not active
0 : Active

D8 : COMREG EP(applied function)
This bit is valid when COMREG ENABLE is set to 1 by the SPEC INITIALIZE3 command.
This bit indicates the storage status of the general-purpose command to be executed next (reserved command).
1 : No reserved command is stored (EMPTY), or COMREG ENABLE is set to 0.
0 : One or more reserved command is stored.

D9 : COMREG FL(applied function)
This bit is valid when COMREG ENABLE is set to 1 by the SPEC INITIALIZE3 command.
This bit indicates the storage status of the general-purpose command to be executed next (reserved command).
1 : Eight reserved commands are stored (FULL), or COMREG ENABLE is set to 0.
0 : Seven or less reserved commands are stored.
◆ When COMREG ENABLE = 0, COMREG EP and COMREG FL are set to 1.
* For the command reservation function, refer to the separate manual "Technical Data A."

D10 : CPPIN(applied function)
Indicates the current input status of the CPPIN signal.
1 : High level input in progress
0 : Low level input in progress
◆ Same data is indicated for both X and Y axes (Z and A axes).

D11 : CPPOUT(applied function)
Indicates the current input status of the CPPOUT signal.
1 : High level input in progress
0 : Low level input in progress
◆ Same data is indicated for both X and Y axes (Z and A axes).

D12 : SPEED CSET (applied function)
Indicates that a speed-oriented drive CHANGE command is in the standby state.
1 : A speed-oriented drive CHANGE command is in the standby state.
0 : There is no speed-oriented drive CHANGE command.
◆ The CHANGE command in standby is executed upon detection of a change operation point of each CHANGE function.
◆ Speed-oriented drive CHANGE commands include UP DRIVE, DOWN DRIVE, CONST DRIVE, SPEED CHANGE, and RATE CHANGE.
◆ Drive CHANGE signals include SS0 and SS1 for which the input function is set for the UP, DOWN, and CONST DRIVE command signals.
* For the speed-oriented drive CHANGE function, refer to the separate manual "Technical Data A."

D13 : INDEX CSET (applied function)

Indicates that an INDEX CHANGE command is in the standby state.

1 : An INDEX CHANGE command is in the standby state.

0 : Three is no INDEX CHANGE command.

- ◆ The CHANGE command in standby is executed upon detection of a change operation point of each INDEX CHANGE function.
- ◆ INDEX CHANGE commands include INC INDEX CHANGE, ABS INDEX CHANGE, and PLS INDEX CHANGE.
- * For the INDEX CHANGE function, refer to the separate manual "Technical Data A."

D14 : CPP MASK(applied function)

Indicates the mask status of CPPIN input.

1 : CPPIN input is masked (CPPOUT that is output at high level when CPPIN is masked).

0 : This bit is cleared when the next general-purpose command involving pulse output is executed.

- ◆ Executing MANUAL SCAN drive also clears the bit.
- ◆ CPPIN input is masked by OR (disjunction) of CPP MASK = 1 of X and Y axes.
- ◆ CPPIN input is masked in the following status:
  - ・2-axis interpolation drive is executed.
  - ・The CPPIN mask function of the CP SPEC SET command activates.
- * For the CPPIN mask function, refer to the separate manual "Technical Data A."

D15 : X

Indication is undefined.

(10) DRIVE DATA 1, 2, 3 PORTs (read)

Values of various counters or various types of data are read through these ports.
Reading these ports is always enabled.

◆ When the PORT SELECT command for the data to be read is written to the DRIVE COMMAND PORT, the DRIVE DATA1, DATA2, or DATA3 PORT (READ) becomes the read port for the specified data.
The specification of the read PORT remains unchanged until another PORT SELECT command is executed.
After resetting, the port becomes <u>the read port for pulse counter count data.</u>

◆ When data is read from read ports, the DRIVE DATA3 PORT is read last. When the DATA1 or DATA2 port is read, DATA1, 2, 3 PORT data is retained. When reading the DRIVE DATA3 PORT is finished, DATA1, 2, 3 PORT data is updated.

◆ Even while DATA1, 2, 3 PORT data is retained, data is updated if the PORT SELECT command is written.
Data is retained when a command other than the PORT SELECT command is written.

■PORT SELECT commands (for read PORT selection)

・DATA READ PORT SELECT	: Reads setup data and check data.
・MCC SPEED PORT SELECT	: Reads the speed of drive pulses being output.
・ADDRESS COUNTER PORT SELECT	: Reads the count data of the address counter.
・PULSE COUNTER PORT SELECT	: Reads the count data of the pulse counter.
・DFL COUNTER PORT SELECT	: Reads the count data of the pulse differential counter.
・SPEED COUNTER PORT SELECT	: Reads the measurement data that was latched at the measurement pulse count timing by the pulse cycle counter.
・ADDRESS LATCH DATA PORT SELECT	: Reads the count latch data of the address counter.
・PULSE LATCH DATA PORT SELECT	: Reads the count latch data of the pulse counter.
・DFL LATCH DATA PORT SELECT	: Reads the count latch data of the pulse differential counter.
・SPEED LATCH DATA PORT SELECT	: Reads the count latch data of the pulse cycle counter.

6-2. HENSA PORT

(1) HENSA COMMAND PORT

Writing a command to this port sets data required for the step-out detection control block or clears errors.

Command writing to this port is as follows:

- ・When H.RDY = 1, executable command: Setup command by each HENSA INITIALIZE
- ・Command that is always executable independent of H.RDY status: ECLR command

(2) HENSA DATA1,2 PORTs(write)

Command-executable data to be set in the step-out detection control block is written through these ports.

(3) HENSA STATUS1 PORT

The status of the step-out detection control block is read through this port.

Reading this port is always enabled.

D7	D6	D5	D4	D3	D2	D1	D0
Reserved (0)	Reserved (0)	Reserved (0)	Reserved (0)	Reserved (0)	Reserved (0)	Reserved (0)	H.RDY

＊The bit becomes 1 in the active state.

D0 ：H.RDY

Indicates that a command can be written to the HENSA function block.

1 ：Commands can be written.

0 ：Command processing is in progress.

D15--D1 ：Reserved. 0 is output.

(4) HENSA DATA1,2 PORTs(read)

Various types of data of the HENSA function block are read through these ports.

＊ For the step-out detection function using the HENSA DATA PORT or HENSA COMMAND PORT, refer to the separate manual "Technical Data A."

6-3. HARD CONFIGURATION PORT

(1) HARD CONFIG COMMAND PORT

Writing a CONFIGURATION COMMAND to this port sets the C-V870 hardware function or operates the function.
Writing a command to this port is always enabled.
The C-V870 has the following hardware setup and operation functions:

- Selecting SIGNAL OUT3-0 signal output functions of the J2 connector, and setting the output time of SIGNAL OUT3-0 signals
- Selecting SIGNAL IN3-0 signal of the J2 connector, and SENSOR1-0 signal input functions of the J1 connector
- Assigning the synchronous start function to signals, and synchronous start function by the PAUSE command
- General-purpose I/O batch processing function (applied function) that reads or writes IN0 input signals or OUT0 output signals of each axis in a batch
  - ＊ For the general-purpose I/O batch processing function, refer to the separate manual "Technical Data A."

(2) HARD CONFIG DATA1, 2, 3 PORTs (write)

The HARD CONFIG DATA1 PORT, DATA2 PORT, and DATA3 PORT are used to write hardware data to be set through the HARD CONFIG COMMAND PORT.
Writing to these ports is always enabled.

(3) SIGNAL STATUS PORT

This port is used to read the current status of SIGNAL OUT3-0 output signals of the J2 connector, SIGNAL IN3-0 input signals, and general-purpose I/O of each axis. Reading this port is always enabled.

D15	D14	D13	D12	D11	D10	D9	D8
AIN0	ZIN0	YIN0	XIN0	SIGNAL IN3	SIGNAL IN2	SIGNAL IN1	SIGNAL IN0

D7	D6	D5	D4	D3	D2	D1	D0
AOUT0	ZOUT0	YOUT0	XOUT0	SIGNAL OUT3	SIGNAL OUT2	SIGNAL OUT1	SIGNAL OUT0

(Shaded) Applied functions
Refer to the separate manual "Technical Data A."

＊Each of these bits becomes 1 in the active state.

D3--D0 ：SIGNAL OUT3--0
Indicates the output status of SIGNAL OUT3-0 signals.
1 ：Active SIGNAL OUT signals are output.
0 ：No SIGNAL OUT signals are output.

D11--D8 ：SIGNAL IN3--0
Indicates the input status of SIGNAL IN3-0 signals.
1 ：Active SIGNAL IN signals are input.
0 ：No SIGNAL IN signals are input.

D7--D4 ：AOUT0,ZOUT0,YOUT0,XOUT0 (initial value: always 0; applied function)
D14--D12 ：AIN0 ,ZIN0 ,YIN0 ,XIN0 (initial value: always 0; applied function)
The current status of OUT0 and IN0 signals of each axis can be read in a batch.
1 ：Active signals are input.
0 ：Nonactive signals are input.
◆ When the OUT0 output function is other than general-purpose output (such as INT output), the value that is read from this STATUS is always 0.
＊ For the settings used to enable the general-purpose I/O batch processing function, refer to the separate manual "Technical Data A."

(4) HARD CONFIG DATA1,2,3 PORTs (read)

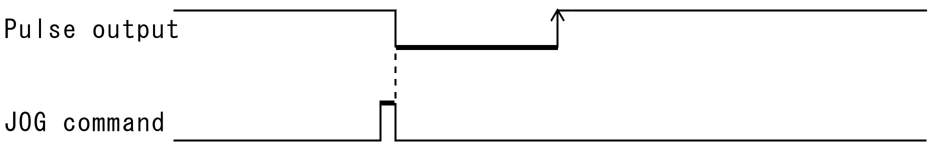
The HARD CONFIG DATA1 PORT, DATA2 PORT, and DATA3 PORT are used to read hardware data that has been set through each HARD CONFIG COMMAND PORT.
Reading these ports is always enabled.

7. DESCRIPTION OF BASIC DRIVE

7-1. Basic Drive

(1) JOG drive

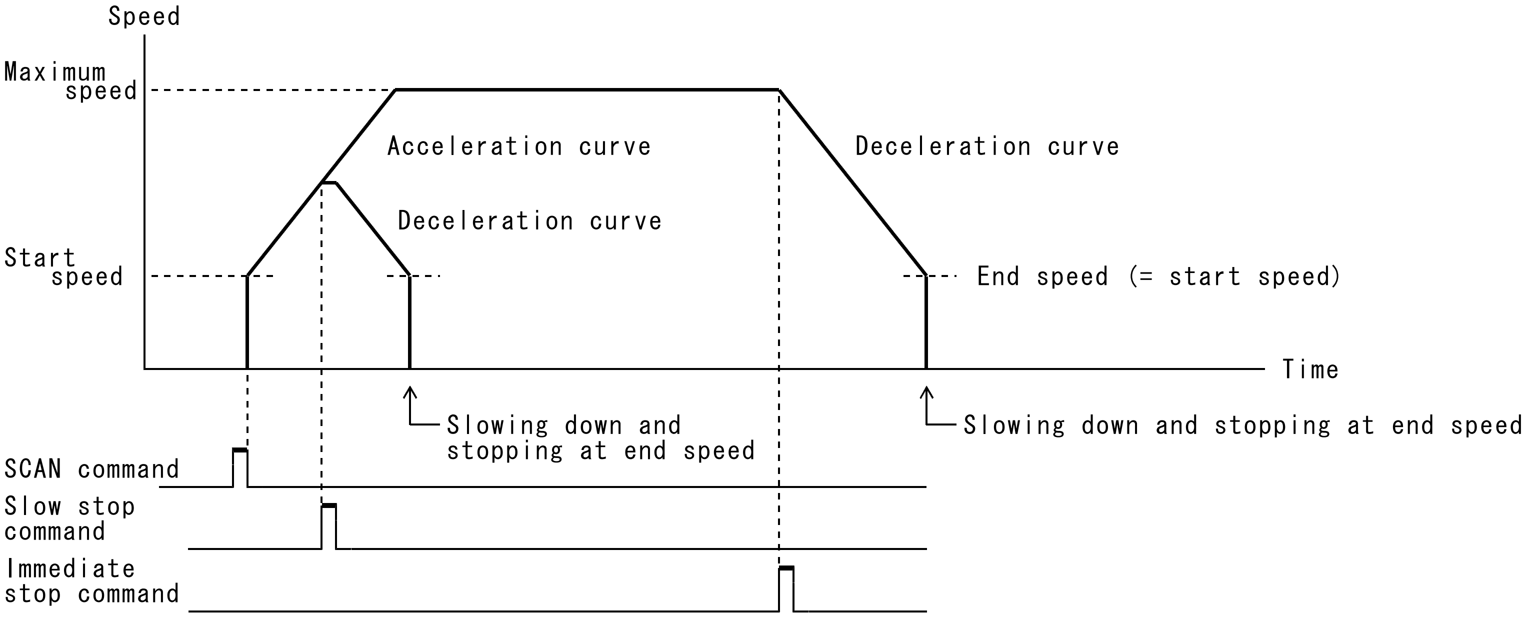
Executing the +/- JOG command outputs a single pulse.



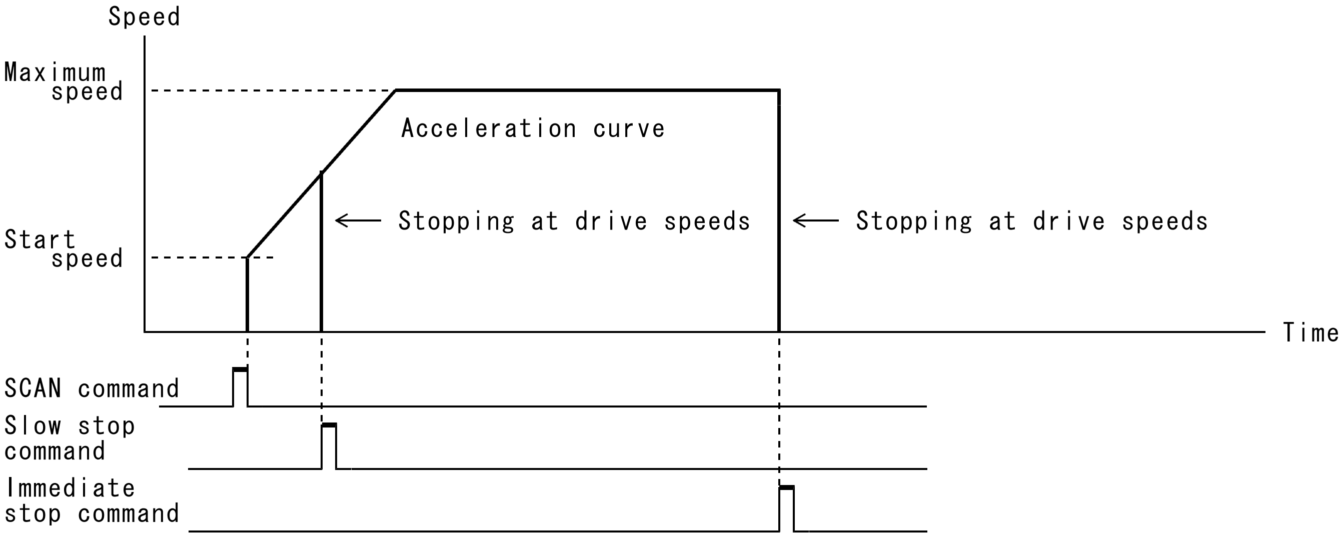
(2) SCAN drive

Executing the +/- SCAN command outputs pulses continuously until a stop command is detected. Upon detection of a slow stop command, the system slowly stops pulse output and ends drive. Upon detection of an immediate stop command, it immediately stops pulse output and ends drive.

■ Stop operation by a slow stop command



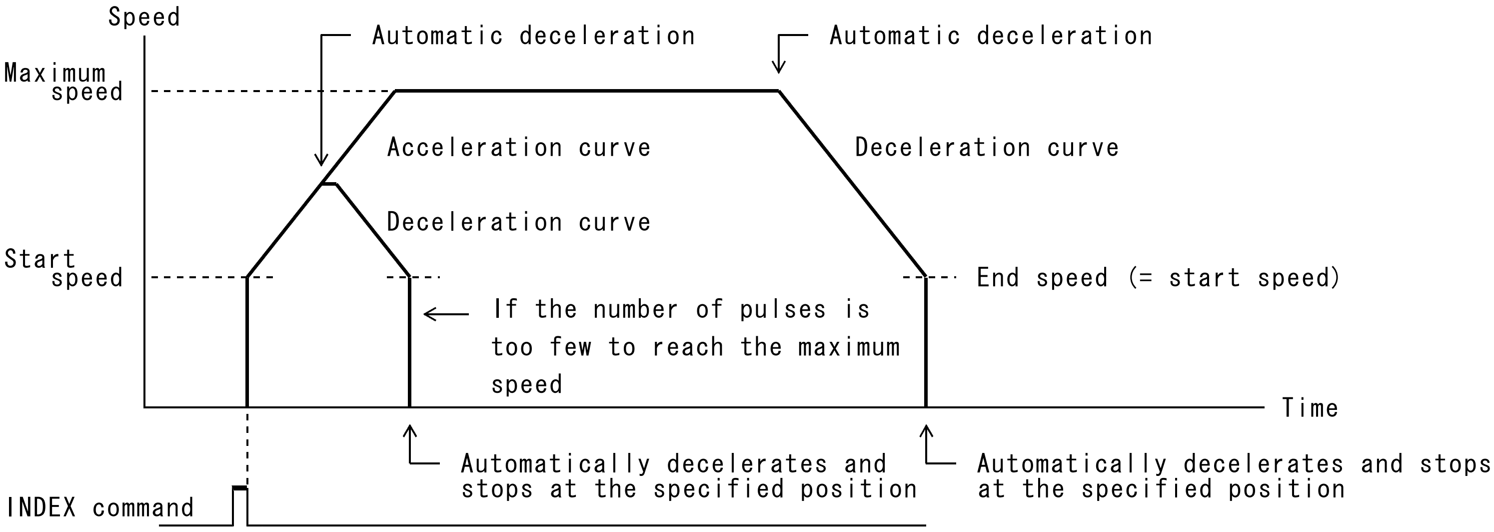
■ Stop operation by an immediate stop command



(3) INDEX drive

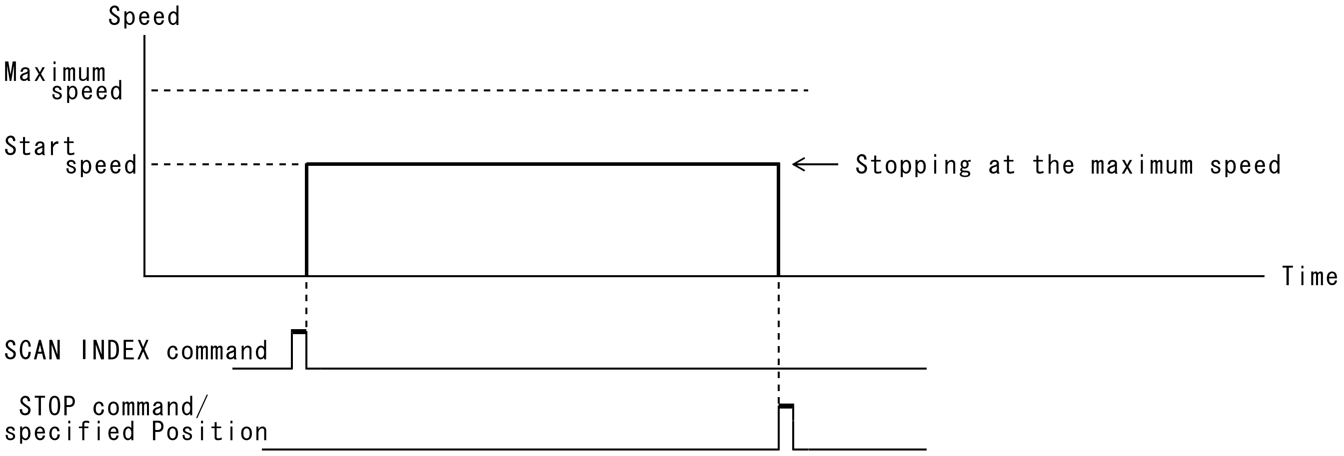
Executing the INC INDEX command outputs pulses until the specified relative address is reached. Executing the ABS INDEX command outputs pulses until the specified absolute address is reached. During acceleration or deceleration drive, it automatically slows down the pulse speed and stops at the specified position. Upon detection of a slow stop command, it slowly stops pulse output and ends drive. Upon detection of an immediate stop command, it immediately stops pulse output and ends drive.

■ Stop operation by automatic deceleration function



(4) Constant speed drive

If the maximum speed is set below the start speed, it outputs pulses constantly at the maximum speed.



7-2. Example of Execution Sequence

To control the C-V870 with a motor, select the motor type and set the functions required for drive. Each function is reset to the initial value by reset operation. Set the functions that need to be changed from their initial values.

※ In the C-870 execution sequence, the OUT3 signal needs to be set by the HARD INITIALIZE1 command in ③ below. Use the OUT3 signal after changing the setting from initial value "RDYINT" to "Always Not Active."

Reset

①All settings including the MCC06 and C-V870 hardware settings are initialized. For the initial values, refer to Section 11-1, "Initial Specifications."

Set the motor type.

②Select the motor type, stepping motor or servo motor.

●When using a stepping motor (open loop)

・Select the stepping motor using the HENSA INITIALIZE1 command of the HENSA port. Stepping motor (open loop) is selected by default.

●When using a servo motor

・Select the servo motor using the HENSA INITIALIZE1 command of the HENSA port.
・MExecute SERVO SPEC for the MCC06: Set the DNED, DRST, and DALM functions.

●When using a stepping motor (step-out detection)

・Select the stepping motor (step-out detection) using the HENSA INITIALIZE1 command of the HENSA port.

・Execute SERVO SPEC for the MCC06: Set the DRST and DALM functions. The DEND function need not be set because it will not be used.

・Execute each HENSA INITIALIZE for the HENSA port: Set parameters required for step-out detection.

*The step-out detection function is an applied function. For details, refer to the separate manual "Technical Data A."

Set the operation specifications.

③Set the other operation specifications.

・Execute SPEC INITIALIZE1 for the MCC06: Set the pulse output specifications and rate setting range.

・Execute SPEC INITIALIZE2 for the MCC06: Set the limit, MCC06 SS0, SS1 function, and RDYINT output function.

・Execute SPEC INITIALIZE1 for the MCC06: Set the MCC06 SIGNAL OUTA and OUTB interrupt signal functions.Change the setting of the initial value of OUT3 from "RDYINT" to "Always Not Active."

・Execute the HARD CONFIGURATION command for each HARD CONFIG port: Assign signal functions to the axes corresponding to I/O.

Set the counter function.

④Set the function of each counter.

・Each COUNTER INITIALIZE1 : Select count pulses, and set INT and COMP1 detection conditions.

・Each COUNTER INITIALIZE2 : Set the COMP2 and COMP3 detection conditions.

・Each COUNTER INITIALIZE3 : Set count pulse division.

Initialize counters.

⑤Initialize counters.

・ADDRESS COUNTER PRESET :Set the current position of the address counter.

・PULSE COUNTER PRESET :Set the initial value of the pulse counter.

・DFL COUNTER PRESET :Set the initial value of the pulse differential counter.

Set machine origin detection parameters.

⑥Set the parameters required for machine origin detection drive.

・LSPD,HSPD : Set the parameters required for low speed or high speed drive.

・ORG SPEC SET : Set the ORIGIN DRIVE operation specifications.

・ORG CSPD SET : Set the constant speed of the ORIGIN detection process.

・ORG DELAY SET : Set the DELAY TIME between individual drive processes and the number of MARGIN pulses.

・ORG OFFSET PULSE SET : Set the number of offset pulses near the machine origin.

・CSCAN ERROR PULSE SET : Set the number of pulses by which an error in the CONSTANT SCAN process is determined.

・JOG ERROR PULSE SET : Set the number of pulses by which an error in the JOG process is determined.

Execute ORIGIN drive.

⑦Execute ORIGIN drive.

Confirm that device setup such as for machine origin detection is complete. If it has been successfully completed, set the parameters for the next drive and execute the drive.

Set drive function parameters.

⑧Set the parameters required for the target drive.

Execute drive.

⑨Execute the target drive.

(Dashed box): Do this operation when the initial value or the parameter valuethat has been set needs to be changed.

8. BASIC FUNCTION

8-1. Setting Basic Drive Parameters

Use the SPEC INITIALIZE1 command to set pulse output specifications and RATE setting range (or RATE compute mode).

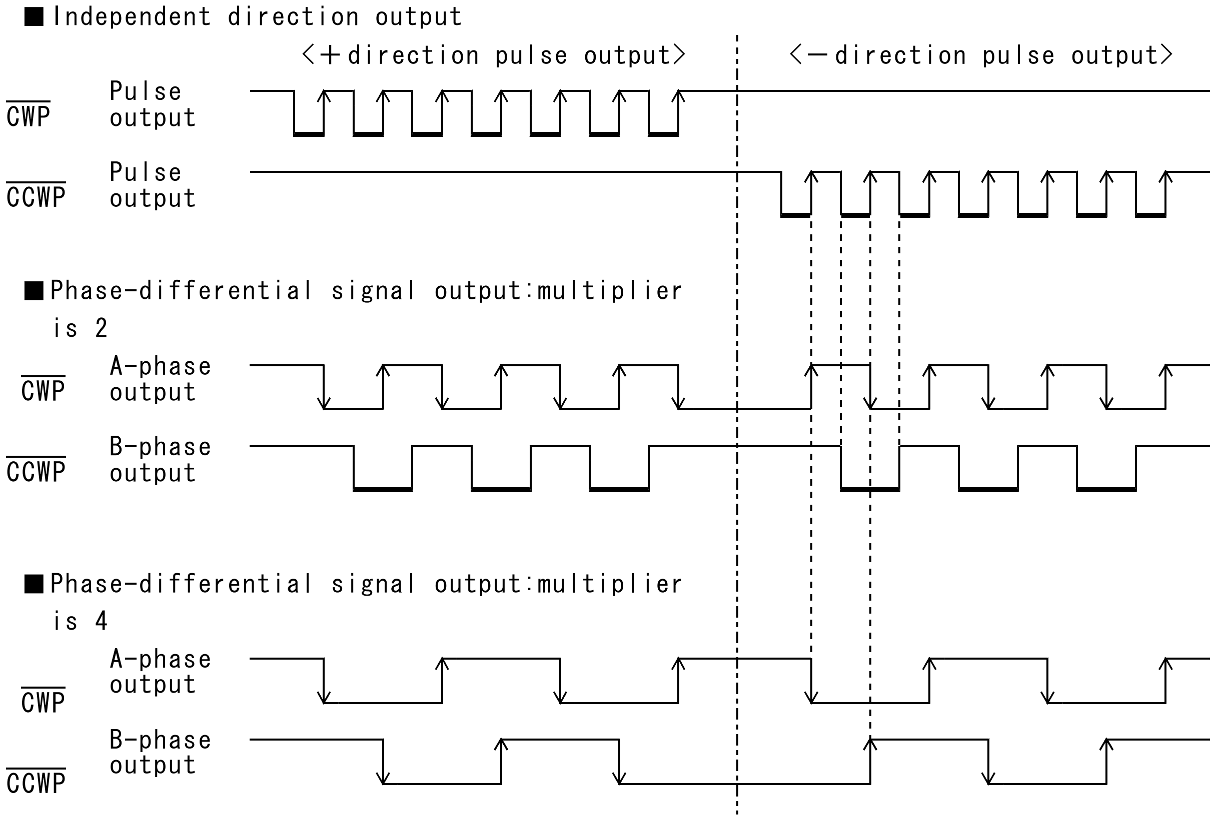
Set operation specifications

① Use the SPEC INITIALIZE1 command to set the parameters required for drive.

Do this operation when the initial value or the parameter value that has been set needs to be changed.

(1) Selecting pulse output modes

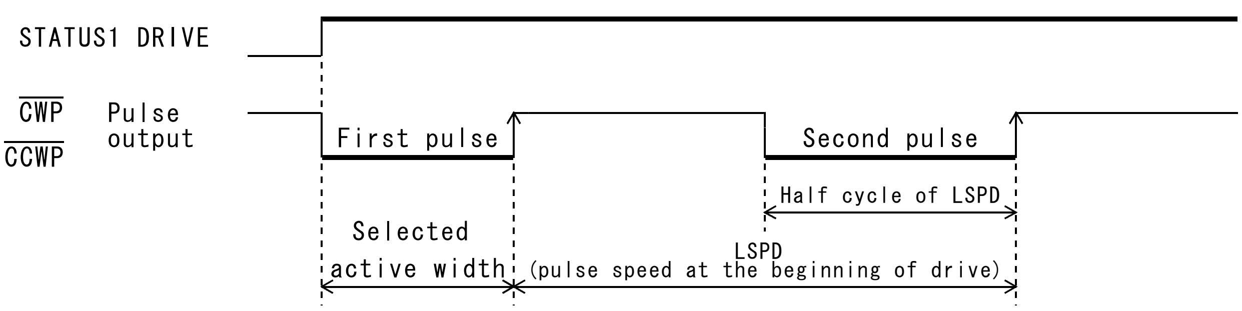
Select the drive pulse output mode of CWP and CCWP signal outputs.
Arrows show the end edges of drive pulse outputs.



phase-differential signal output: multiplier is 2

(2) Selecting active width of the first pulse

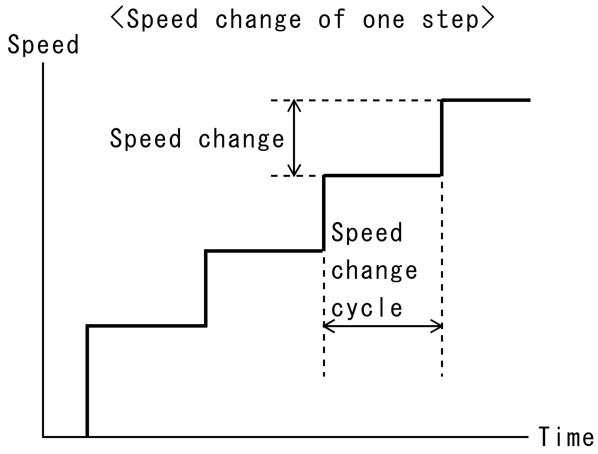
The first pulse at the beginning of drive is output with the active width selected at FIRST PULSE TYPE.
Decreasing the initial value 100 μs to 20 or 2 μs can shorten the time before motor activation.



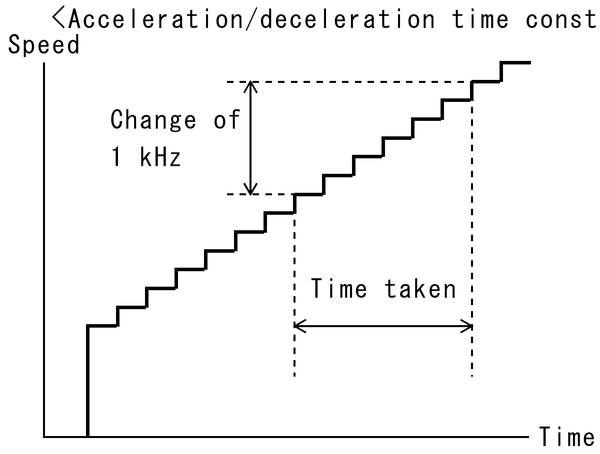
(3) Setting acceleration and deceleration time constants

Acceleration or deceleration is implemented by adding or subtracting speed changes every speed change cycle. The acceleration/deceleration time constant is represented by the time (ms/kHz) required to change the speed by 1 kHz. In this manual, this time constant is referred to as RATE.

〈Speed change of one step〉



〈Acceleration/deceleration time constant〉



Determining the speed change per speed change cycle automatically determines the RATE setting range. To set the acceleration/deceleration time constant, first determine the adequate speed change for the system and motor used. Next, select the acceleration/deceleration time constant according to the purpose from the RATE setting range determined by the speed change.

◆ Make settings as follows:
・Setting the RATE TYPE : Use the SPEC INITIALIZE1 command.
・Setting the RATE : Use the RATE SET or SRATE SET command.
◆ To use the compute mode, set the RATE TYPE to "compute mode." (RATE TYPE2-0 = "110")
* For the compute mode, refer to the separate manual "Technical Data A."

(4) RATE DATA TABLE

TABLE No.	RATE (ms/kHz)	TABLE No.	RATE (ms/kHz)	TABLE No.	RATE (ms/kHz)	TABLE No.	RATE (ms/kHz)
H'00	1000	H'20	47	H'40	2.2	H'60	0.10
H'01	910	H'21	43	H'41	2.0	H'61	0.091
H'02	820	H'22	39	H'42	1.8	H'62	0.082
H'03	750	H'23	36	H'43	1.6	H'63	0.075
H'04	680	H'24	33	H'44	1.5	H'64	0.068
H'05	620	H'25	30	H'45	1.3	H'65	0.062
H'06	560	H'26	27	H'46	1.2	H'66	0.056
H'07	510	H'27	24	H'47	1.1	H'67	0.051
H'08	470	H'28	22	H'48	1.0	H'68	0.047
H'09	430	H'29	20	H'49	0.91	H'69	0.043
H'0A	390	H'2A	18	H'4A	0.82	H'6A	0.039
H'0B	360	H'2B	16	H'4B	0.75	H'6B	0.036
H'0C	330	H'2C	15	H'4C	0.68	H'6C	0.033
H'0D	300	H'2D	13	H'4D	0.62	H'6D	0.030
H'0E	270	H'2E	12	H'4E	0.56	H'6E	0.027
H'0F	240	H'2F	11	H'4F	0.51	H'6F	0.024
H'10	220	H'30	10	H'50	0.47	H'70	0.022
H'11	200	H'31	9.1	H'51	0.43	H'71	0.020
H'12	180	H'32	8.2	H'52	0.39	H'72	0.018
H'13	160	H'33	7.5	H'53	0.36	H'73	0.016
H'14	150	H'34	6.8	H'54	0.33		
H'15	130	H'35	6.2	H'55	0.30		
H'16	120	H'36	5.6	H'56	0.27		
H'17	110	H'37	5.1	H'57	0.24		
H'18	100	H'38	4.7	H'58	0.22		
H'19	91	H'39	4.3	H'59	0.20		
H'1A	82	H'3A	3.9	H'5A	0.18		
H'1B	75	H'3B	3.6	H'5B	0.16		
H'1C	68	H'3C	3.3	H'5C	0.15		
H'1D	62	H'3D	3.0	H'5D	0.13		
H'1E	56	H'3E	2.7	H'5E	0.12		
H'1F	51	H'3F	2.4	H'5F	0.11		

(5) RATE setting range

RATE TYPE	RATE setting range(ms/kHz)	TABLE No. setting range	Speed change(Hz)	RESOL
L1-TYPE	1,000 ~ 3.3	H'00 ~ H'3C	50	1
L2-TYPE	200 ~ 0.68	H'11 ~ H'4C	250	5
M1-TYPE	100 ~ 0.33	H'18 ~ H'54	500	10
M2-TYPE	51 ~ 0.16	H'1F ~ H'5B	1,000	20
H1-TYPE	20 ~ 0.068	H'29 ~ H'64	2,500	50
H2-TYPE	5.1 ~ 0.016	H'37 ~ H'73	10,000	200

8-2. Setting the LIMIT Signal, Sensor Signal Parameters, and RDYINT Specifications

Use the SPEC INITIALIZE2 command to set the LIMIT stop function, SS0, SS1 signal function, and RDYINIT specifications.

Set operation specifications	① Use the SPEC INITIALIZE2 command to set necessary parameters.
(dashed box)	Do this operation when the initial value or the parameter value that has been set needs to be changed.

(1) Selecting the LIMIT stop mode

The CWLM and CCWLM signals can be used to externally stop drive pulse output in each direction. Use the input function setting to use the CWLM and CCWLM signal inputs as a slow stop signal or fast stop signal in each direction.

(2) Selecting the SS0 and SS1 signal input function

The MCC06 SS0 and SS1 signals can be used as general-purpose input signals, immediate stop signals, slow stop signals, drive CHANGE UP, DOWN, and CONST DRIVE commands, and trigger inputs of various functions.

The HARD CONFIGURATION1 command can be used to select connections from external signals of the C-V870 to the MCC06 SS0 and SS1 signals.

* For the drive CHANGE function, refer to the separate "Technical Data A."

■ Various MCC06 functions that can use SS0 and SS1 signals as trigger signals

・Synchronous start
・Start of measuring pulse cycle counter
・Counter data latching and clearing
・Execution of UP, DOWN, or CONST drive CHANGE
・Execution of SPEED CHANGE
・Execution of INDEX CHANGE

(3) Selecting RDYINT specifications

The RDYINT signal can be output to PCI bus interrupt output INTA# or to the outside from SIGNAL OUT3-0 signals.

The output specifications of interrupt request RDYINT at the end of command processing can be selected from the following:

・End of drive (STATUS1 PORT DRVEND = 1)
・End of drive and command processing (STATUS1 PORT BUSY = 0)
・RDYINT is not output.

■RDYINT clearance conditions

RDYINT output is set to off under the following conditions:

・End of STATUS1 PORT reading
・Execution of a general-purpose command
・Execution of the ADDRESS COUNTER PRESET command
・Execution of the ADDRESS COUNTER MAX COUNT SET command
・Execution of encoder signal output function (STATUS1 PORT EXT PULSE = 1)

8-3. Setting a Delay in Continuous Drive and Reverse Drive

For continuous drive or reverse END PULSE drive, setting adequate delay time between drives can suppress machine vibration. Use the DRIVE DELAY SET command to set the delay time.

Set drive function parameters	① Use the DRIVE DELAY SET command to set parameters.
(dashed box)	Do this operation when the initial value or the parameter value that has been set needs to be changed.

Insert the DRIVE DELAY TIME immediately before the following types of continuous drive start:

・End-point correction drive of circular interpolation drive
・END PULSE drive that reverses
・Continuous drive by the command reservation function (execution of a general-purpose command involving output of the next pulse)

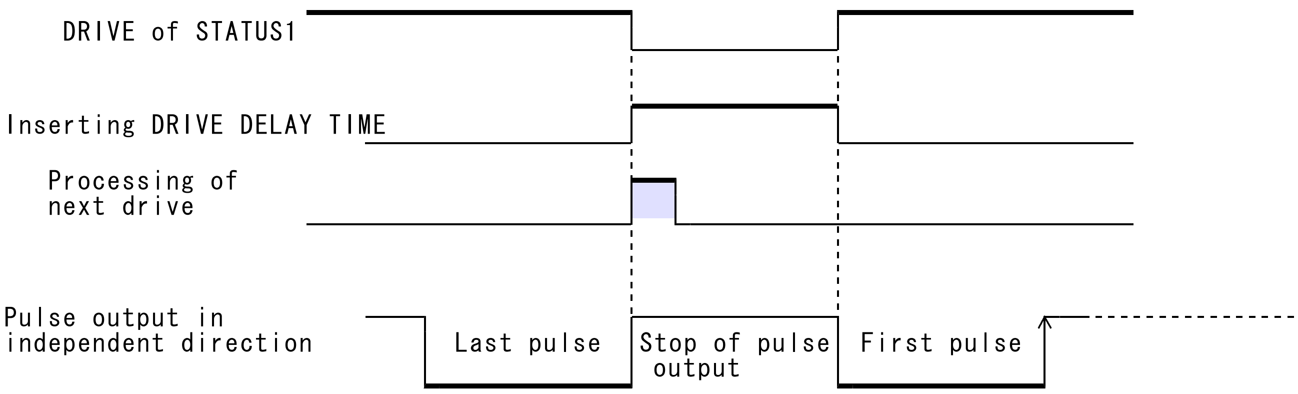
* For the command reservation function, refer to the separate manual "Technical Data A."

Processing of the next drive is performed in parallel during continuous drive, and pulse output starts after the DRIVE DELAY TIME ends. If the DRIVE DELAY TIME is 0, a half cycle of the pulse speed (LSPD, SLSPD etc.) at the start of the next drive is inserted.

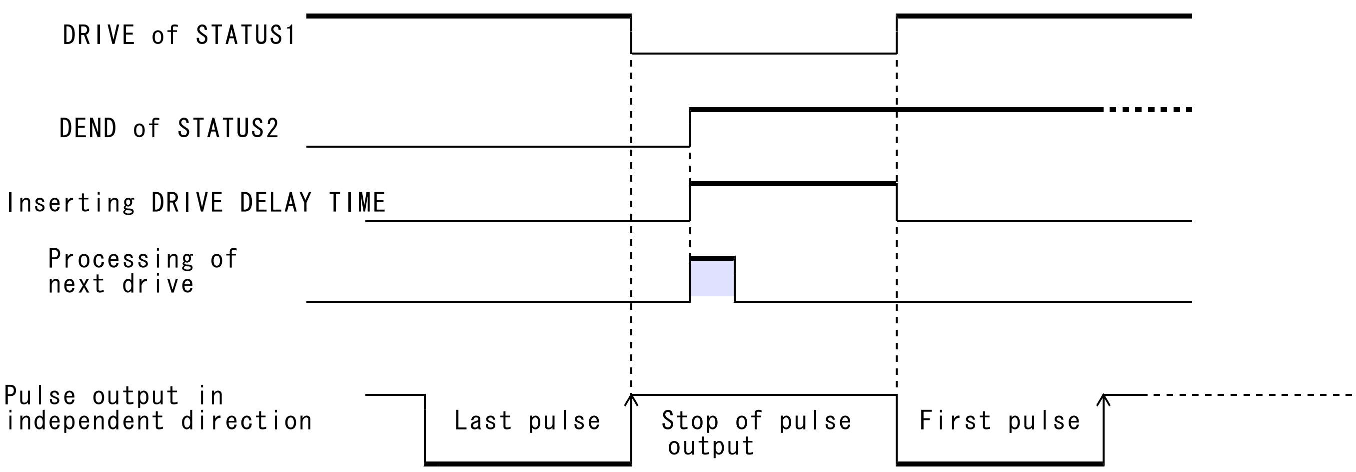
◆ If the processing time of the next drive is longer than the inserted DRIVE DELAY TIME, the processing time of the next drive becomes the DRIVE DELAY TIME.
◆ If another axis is driving (DRIVE = 1), a delay up to 160 μs is caused to the inserted DELAY TIME. In 2-axis interpolation drive mode, the drive of the current axis is not affected by other axes that are driving (DRIVE = 1).

■Inserting DRIVE DELAY TIME

Insert the DRIVE DELAY TIME immediately before execution of continuous drive.



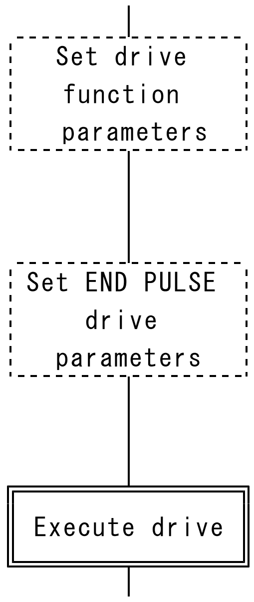
For servo motor specification, insert the DRIVE DELAY TIME after detection of active state of the DEND signal.



8-4. Linear Acceleration/Deceleration Drive

The linear acceleration/deceleration drive accelerates and decelerates according to the acceleration and deceleration curves obtained by approximating the speed area from acceleration start to its end and that from the deceleration start to its end by straight lines.
Setting different values in the acceleration and deceleration curve parameters causes asynchronous linear acceleration/deceleration drive. Continuous drive (SCAN drive) and positioning drive (INDEX drive) can be performed.

■ Execution sequence of linear acceleration/deceleration drive



① Set the parameters required for linear acceleration/deceleration drive.
- ・LSPD : Pulse speed at the beginning of acceleration and end of deceleration
- ・HSPD : Pulse speed at maximum speed
- ・URATE : Acceleration time constant
- ・DRATE : Deceleration time constant

② Set the parameters required for linear acceleration/deceleration END PULSE drive.
- ・END PULSE : Number of pulses for END PULSE drive
- ・ESPD : Pulse speed of END PULSE drive
- ・ESPD DELAY TIME : DELAY TIME till END PULSE drive starts after the end of deceleration

③ Execute drive.

(dashed box) Do this operation when the initial value or the parameter value that has been set needs to be changed.

■ SCAN drive and INDEX drive

The following drive parameters need to be set for linear acceleration/deceleration SCAN/INDEX drive:
- ・LSPD : Pulse speed at the beginning of acceleration and end of deceleration
- ・HSPD : Pulse speed at maximum speed
- ・URATE : Acceleration time constant (acceleration curve parameter)
- ・DRATE : Deceleration time constant (deceleration curve parameter)

■ Linear acceleration/deceleration END PULSE drive

Inserting END PULSE immediately before the end of drive has the effect of suppressing vibration at cessation of the motor.
The END PULSE drive includes the number of END PULSEs in the positioning quantity and operates in consideration of backlash.
The following drive parameters need to be set for the linear acceleration/deceleration END PULSE drive.
- ・END PULSE : Number of END PULSE drive pulses
- ・ESPD : Pulse speed of END PULSE drive
- ・ESPD DELAY TIME : DELAY TIME till END PULSE drive starts after the end of deceleration

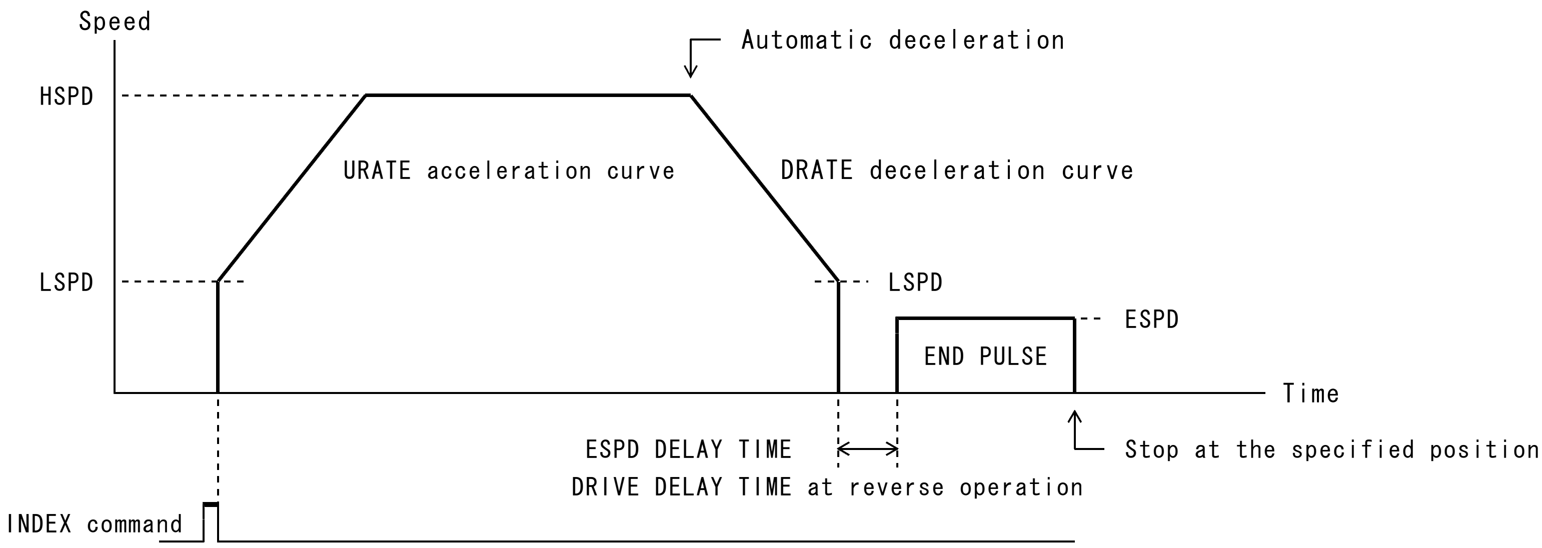
●Commands that enable linear acceleration/deceleration END PULSE drive

COMMAND CODE	DRIVE COMMAND name	COMMAND CODE	DRIVE COMMAND name
H'0022	+SCAN *1	H'0110	ABS STRAIGHT CP
H'0023	-SCAN *1	H'0112	ABS STRAIGHT CONST CP
H'0024	INC INDEX	H'0150	INC STRAIGHT CP
H'0025	ABS INDEX	H'0152	INC STRAIGHT CONST CP
			2-axis circular interpolation drive *2

*1 : This command is enabled when END PULSE STOP MODE of the SPEC INITIALIZE3 command is 1. <Applied function>

*2 : For 2-axis circular interpolation drive, this command is enabled when CIRCULAR CP MODE of the CP SPEC SET command is 0 (correction drive at the end point is not executed). <Applied function>

■ Linear acceleration/deceleration drive and END PULSE drive

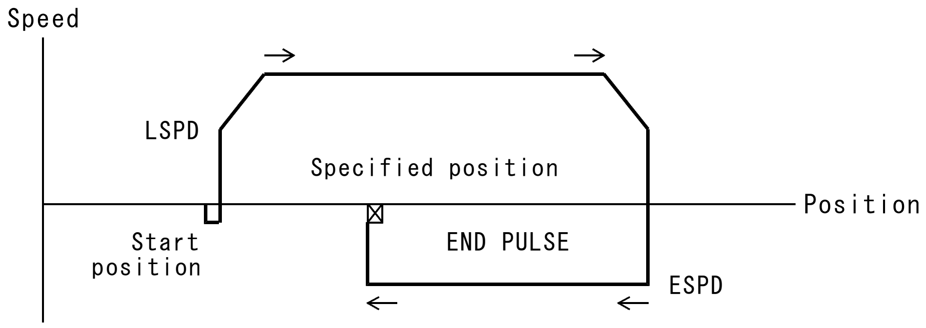


- Specify the last stop position for the specified position (relative address or absolute address) of the INDEX command. It ends acceleration/deceleration drive END PULSE before the specified position and performs END PULSE drive to the specified position.

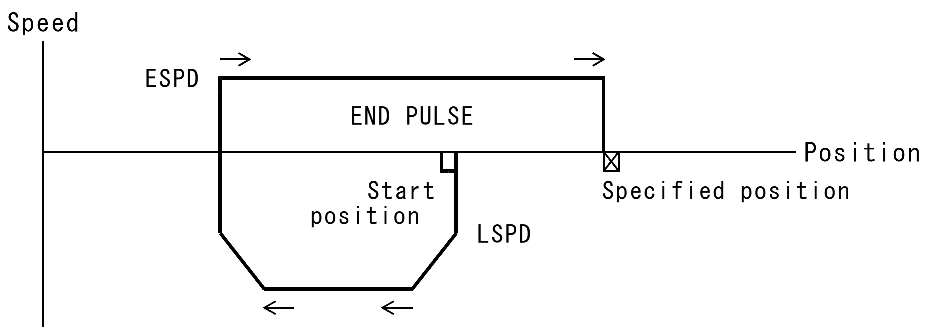
- The relative address is a signed value that represents the number of pulses from the start position to the stop position assuming that the start position is the origin. The absolute address is one that is managed by the address counter.

- If END PULSE is set to 0, linear acceleration/deceleration END PULSE drive is not executed. Only acceleration/deceleration drive is executed.

●Reverse operation of END PULSE drive



- When the END PULSE drive is in the opposite direction of the start direction, the system, to secure END PULSE, ends acceleration/deceleration drive at the position END PULSE passed from the specified position and then performs END PULSE drive to the specified position.



- When the number of pulses from the start position to the specified position is less than END PULSE, it, to secure END PULSE, moves in the opposite direction and then performs END PULSE drive to the specified position.

8-5. S-curve Acceleration/Deceleration Drive

S-curve acceleration/deceleration drive is implemented according to the S-curve acceleration curve and S-curve deceleration curve obtained by approximating the four speed areas (acceleration start, acceleration end, deceleration start, deceleration end) to parabolic curves.
Between acceleration areas and between deceleration areas, it performs acceleration or deceleration according to the acceleration curve or deceleration curve that has been approximated by a linear curve.
Setting different values in the acceleration and deceleration curve parameters causes asynchronous S-curve acceleration/deceleration drive.

■ Execution sequence of S-curve acceleration/deceleration drive

Set drive function parameters

① Set the parameters required for S-curve acceleration/deceleration drive.

- ・SLSPD : Pulse speed at the beginning of acceleration and end of deceleration
- ・SHSPD : Pulse speed at maximum speed
- ・SURATE : Acceleration time constant between SCAREA1 and SCAREA2
- ・SDRATE : Deceleration time constant between SCAREA3 and SCAREA4
- ・SCAREA1 : Speed area of S-acceleration curve from acceleration start to SURATE start
- ・SCAREA2 : Speed area of S-acceleration curve from SURATE end to acceleration end
- ・SCAREA3 : Speed area of S-acceleration curve from deceleration start to SDRATE start
- ・SCAREA4 : Speed area of S-acceleration curve from SDRATE end to deceleration end of deceleration

Set END PULSE drive parameters

② Set the parameters required for S-curve acceleration/deceleration END PULSE drive.

- ・SEND PULSE : Number of pulses for END PULSE drive
- ・SESPD : Pulse speed of END PULSE drive
- ・SESPD DELAY TIME : DELAY TIME till END PULSE drive starts after the end of deceleration

Execute drive

③ Execute drive.

(Dashed box) Do this operation when the initial value or the parameter value that has been set needs to be changed.

■ SRATE SCAN drive and SRATE INDEX drive

The following drive parameters need to be set for S-curve acceleration/deceleration SRATE SCAN/INDEX drive:

- ・SLSPD : Pulse speed at the beginning of acceleration and end of deceleration
- ・SHSPD : Pulse speed at maximum speed
- ・SURATE : Acceleration time constant between SCAREA1 and SCAREA2 (acceleration curve parameter)
- ・SDRATE : Deceleration time constant between SCAREA3 and SCAREA4 (deceleration curve parameter)
- ・SCAREA1 : Speed area of S-acceleration curve from the start of acceleration to the start of SURATE
  The S-acceleration curve from the start of acceleration is automatically decided by setting SURATE and SCAREA1.
- ・SCAREA2 : Speed area of S-acceleration curve from the end of SURATE to the end of acceleration
  The S-acceleration curve to the end of acceleration is automatically decided by setting SURATE and SCAREA2.
- ・SCAREA3 : Speed area of S-acceleration curve from the start of deceleration to the start of SDRATE
  The S-deceleration curve from the start of deceleration is automatically decided by setting SDRATE and SCAREA3.
- ・SCAREA4 : Speed area of S-acceleration curve from the end of SDRATE to the end of deceleration
  The S-deceleration curve to the end of deceleration is automatically decided by setting SDRATE and SCAREA4.

■ S-curve acceleration/deceleration END PULSE drive

Inserting END PULSE immediately before the end of drive has the effect of suppressing vibration at cessation of the motor.
The END PULSE drive includes the number of END PULSEs in the positioning quantity and operates in consideration of backlash.
The following drive parameters need to be set for the S-curve acceleration/deceleration END PULSE drive.

- ・SEND PULSE : Number of END PULSE drive pulses
- ・SESPD : Pulse speed of END PULSE drive
- ・SESPD DELAY TIME : DELAY TIME till END PULSE drive starts after the end of deceleration

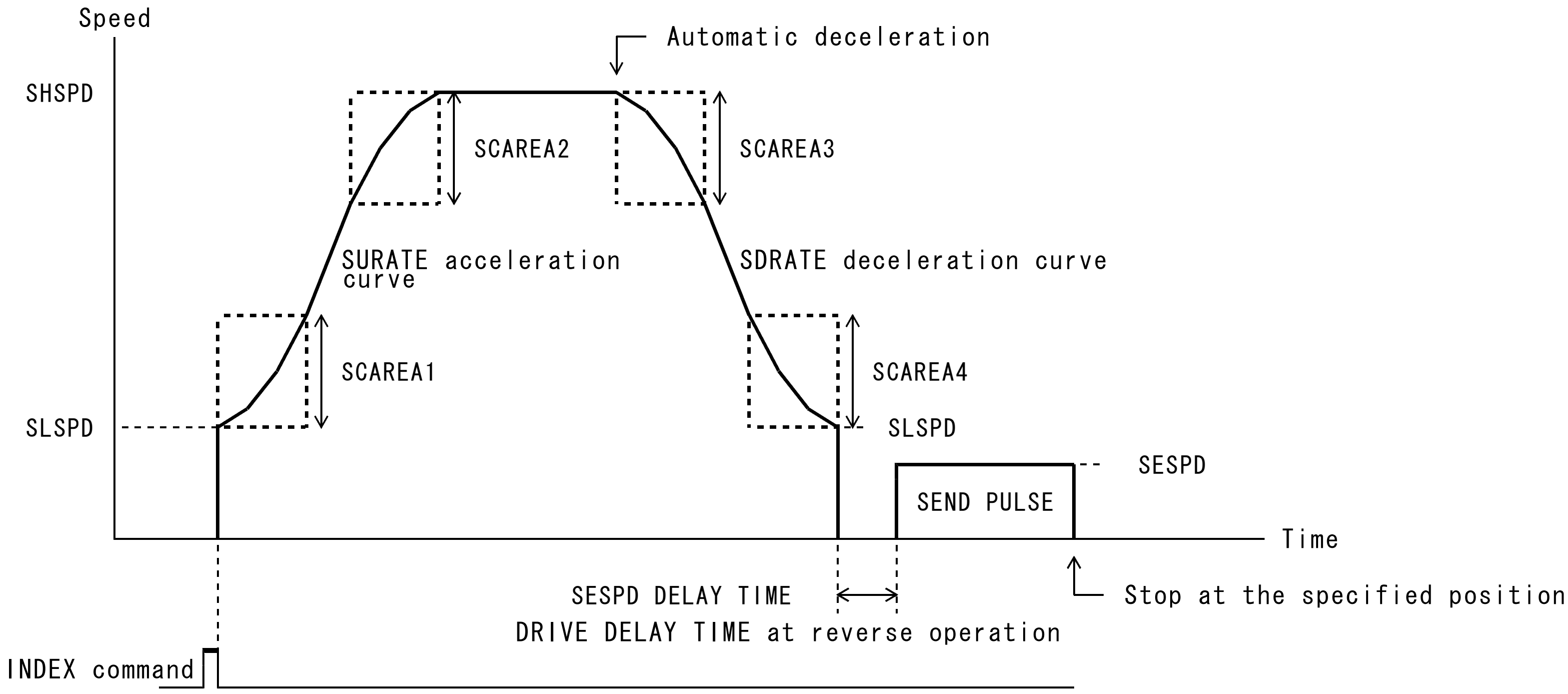
●Commands that enable S-curve acceleration/deceleration END PULSE drive

COMMAND CODE	DRIVE COMMAND name	COMMAND CODE	DRIVE COMMAND name
H'0042	+SRATE SCAN *1	H'0111	ABS SRATE STRAIGHT CP
H'0043	-SRATE SCAN *1	H'0113	ABS SRATE STRAIGHT CONST CP
H'0044	INC SRATE INDEX	H'0151	INC SRATE STRAIGHT CP
H'0045	ABS SRATE INDEX	H'0153	INC SRATE STRAIGHT CONST CP
			2-axis circular interpolation drive *2

*1 : This command is enabled when END PULSE STOP MODE of the SPEC INITIALIZE3 command is 1. <Applied function>

*2 : For 2-axis circular interpolation drive, this command is enabled when CIRCULAR CP MODE of the CP SPEC SET command is 0 (correction drive at the end point is not executed). <Applied function>

■ S-curve acceleration/deceleration drive and END PULSE drive



・Specify the last stop position for the specified position (relative address or absolute address) of the SRATE INDEX command. It ends acceleration/deceleration drive SEND PULSE before the specified position and performs END PULSE drive to the specified position.

・The relative address is a signed value that represents the number of pulses from the start position to the stop position assuming that the start position is the origin. The absolute address is one that is managed by the address counter.

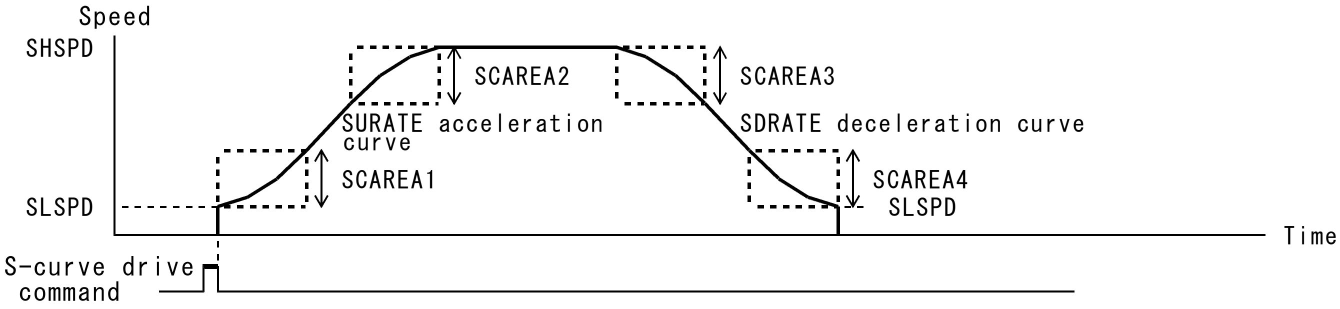
・If SEND PULSE is set to 0, S-curve acceleration/deceleration END PULSE drive is not executed. Only acceleration/deceleration drive is executed.

●Reverse operation of END PULSE drive
The operation of S-curve acceleration/deceleration END PULSE drive is the same as linear acceleration/deceleration END PULSE drive.

■ Setting S-curve acceleration/deceleration areas

S-curve acceleration/deceleration drive is implemented according to the S-curve acceleration curve and S-curve deceleration curve obtained by approximating the four speed areas (acceleration start, acceleration end, deceleration start, deceleration end) to parabolic curves.
Between acceleration areas and between deceleration areas, it performs acceleration or deceleration according to the acceleration curve or deceleration curve that has been approximated by a linear curve.
Setting different values in the acceleration and deceleration curve parameters causes asynchronous S-curve acceleration/deceleration drive.

●S-curve acceleration/deceleration drive



●SCAREA1 : Speed area of S-acceleration curve from the start of acceleration to the start of SURATE
The S-acceleration curve from the start of acceleration is automatically decided by setting SURATE and SCAREA1.

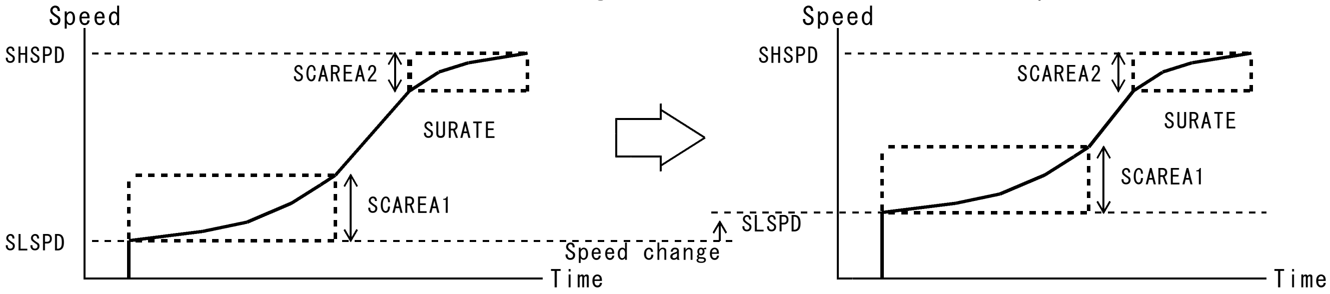
●SCAREA2 : Speed area of S-acceleration curve from the end of SURATE to the end of acceleration
The S-acceleration curve to the end of acceleration is automatically decided by setting SURATE and SCAREA2.

●SCAREA3 : Speed area of S-acceleration curve from the start of deceleration to the start of SDRATE
The S-deceleration curve from the start of deceleration is automatically decided by setting SDRATE and SCAREA3.

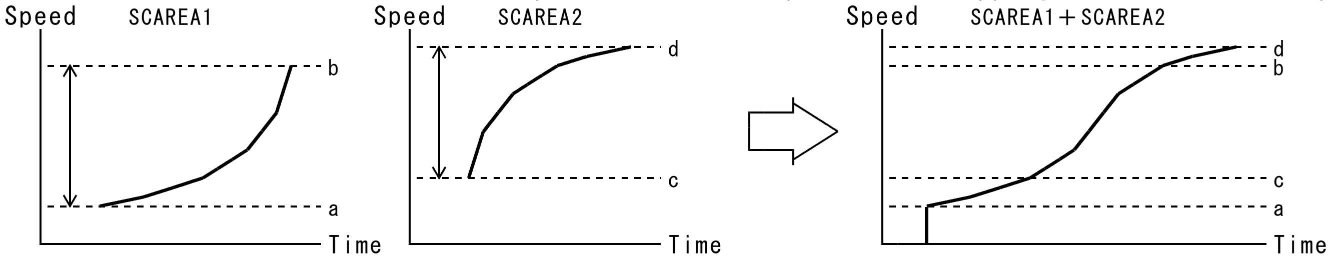
●SCAREA4 : Speed area of deceleration curve from the end of SDRATE to the end of deceleration
The S-deceleration curve to the end of deceleration is automatically decided by setting SDRATE and SCAREA4.

●SCAREA12 setting (by the SCAREA12 SET command)

◆ Even if SLSPD and SHSPD are changed, the SCAREA1 and SCAREA2 speed areas remain unchanged.

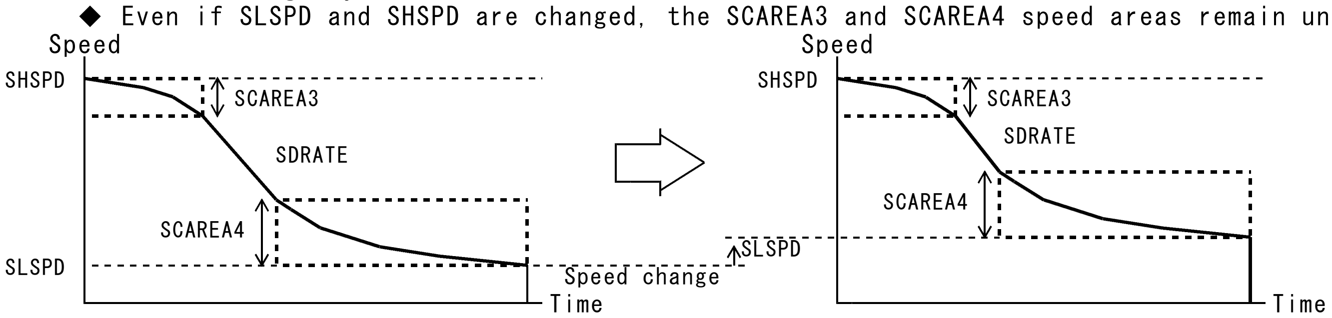


◆ If the SCAREA1 and SCAREA2 speed areas overlap, the overlapping areas are smoothly synthesized.

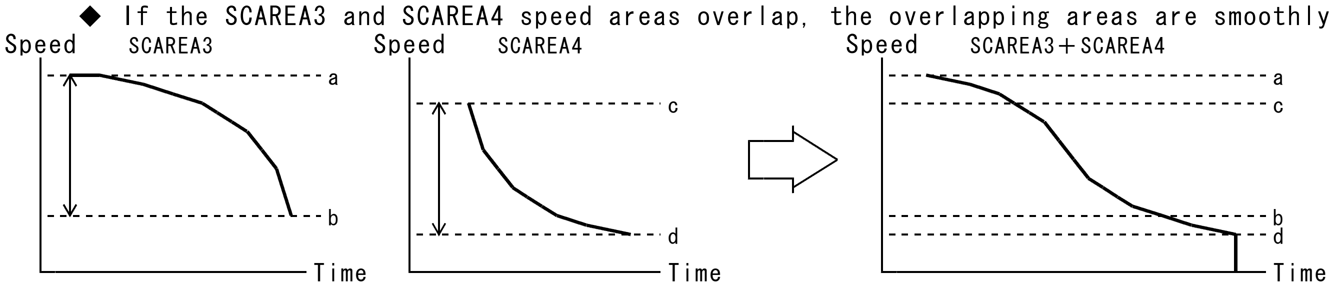


●SCAREA34 setting (by the SCAREA34 SET command)

◆ Even if SLSPD and SHSPD are changed, the SCAREA3 and SCAREA4 speed areas remain unchanged.



◆ If the SCAREA3 and SCAREA4 speed areas overlap, the overlapping areas are smoothly synthesized.



8-6. Detecting Machine Origin (ORIGIN Drive)

Individual drive processes are sequentially executed while detecting sensor signals, and drive ends upon detection of a machine origin signal.
The ORIGIN drive includes nine drive types: ORG-0 to ORG-5 and ORG-10 to ORG-12. The sensor signals detected by ORG-0 to ORG-5 and ORG-10 are ORG, NORG, ±Z phase, or ORG detection signals obtained by synthesizing P0 signal inputs by AND (conjunction).
The sensor signals detected by ORG-11 and ORG-12 are CWLM or CCWLM.
The sensor signals detected by ORG-11 and ORG-12 (CWLM or CCWLM) are selected based on the ORIGIN drive start direction.

■ Parameters required for ORIGIN drive

- Linear acceleration/deceleration or S-curve acceleration/deceleration drive parameters
- ORIGIN SPEC : ORIGIN drive operation specifications
- ORIGIN CSPD : Pulse speed of CONSTANT SCAN process
- ORIGIN DELAY : DELAY TIME between individual drive processes, and the number of MARGIN pulses after signal detection
- OFFSET PULSE : Number of OFFSET pulses at an address near the machine origin
- CSCAN ERROR PULSE : Maximum number of pulses by which an error in the CONSTANT SCAN process is determined
- JOG ERROR PULSE : Maximum number of pulses by which an error in the JOG process is determined
- PRESET PULSE : Number of PRESET pulses of PRESET ORIGIN drive

■ Individual drive processes of ORIGIN drive

ORIGIN drive includes three processes: SCAN, CONSTANT SCAN, and JOG processes.

● SCAN process
It performs SCAN drive based on acceleration/deceleration drive parameters. It slows downand stops upon detection of a sensor signal. The ORIGIN command is used to perform linear acceleration/deceleration drive, and the SRATE ORIGIN command is used to perform S-curve acceleration/deceleration drive.

● CONSTANT SCAN process
It performs constant-speed drive at ORIGIN CSPD pulse speeds. It stops the drive upon detection of a sensor signal.

● JOG process
It repeats the JOG drive at the time interval defined by JOG DELAY TIME of ORIGIN DELAY.
It stops the drive upon detection of a sensor signal.

■ Characteristics of drive type

Drive type	Number of detected sensors	State of sensor at detection completion	Number of drive processes	Time required	Accuracy	CWLM signal input function	CCWLM signal input function
ORG-0	1	OFF	2	Short	Low	LIMIT in + direction	LIMIT in - direction
ORG-1	1	ON	2	Short	Low	LIMIT in + direction	LIMIT in - direction
ORG-2	1	OFF	4	Long	Medium	LIMIT in + direction	LIMIT in - direction
ORG-3	1	ON	4	Long	Medium	LIMIT in + direction	LIMIT in - direction
ORG-4	2	OFF	4/5	Longest	High	LIMIT in + direction	LIMIT in - direction
ORG-5	2	ON	4/5	Longest	High	LIMIT in + direction	LIMIT in - direction
ORG-10	2	ON	2	Shortest	Low	LIMIT in + direction	LIMIT in - direction
ORG-11	1	OFF	2	Short	Low	LIMIT in + direction Detection signal	Detection signal LIMIT in - direction
ORG-12	1	OFF	4	Long	Medium	LIMIT in + direction Detection signal	Detection signal LIMIT in - direction

■ LIMIT signal for the ORIGIN drive

- For the ORIGIN drive, the CWLM and CCWLM signals are used as LIMIT signal.
  Input system LIMIT sensor signals for the CWLM and CCWLM signals.
- In the ORIGIN drive (SCAN, CONSTANT SCAN, and JOG processes), the CWLM signal is detected as a LIMIT stop signal in the + direction and the CCWLM signal is detected as a LIMIT stop signal in the - direction.
- In the ORG-11 or ORG-12 drive, one of the CWLM and CCWLM signals becomes the machine origin signal.
  When the ORIGIN drive start direction is CCW, the CCWLM signal becomes the machine origin signal and the CWLM signal becomes the LIMIT stop signal.
  When the ORIGIN drive start direction is CW, the CWLM signal becomes the machine origin signal and the CCWLM signal becomes the LIMIT stop signal.

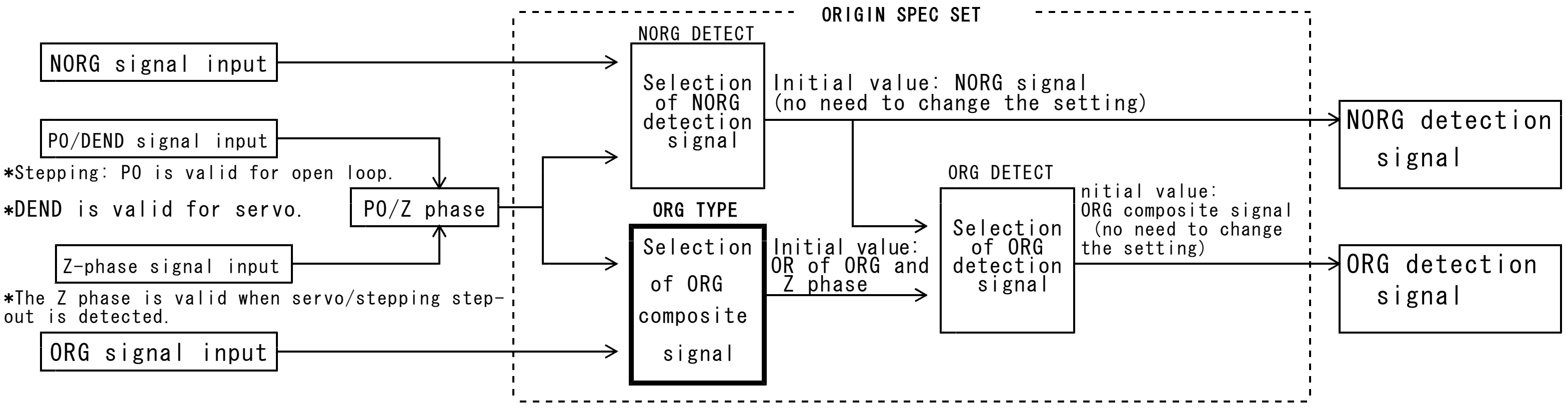
◆ The following drive functions belonging to the ORIGIN drive are handled as drives other than the ORIGIN drive:
- INDEX drive to an address near the machine origin (drive to "machine origin + OFFSET pulse setting address")
- INDEX drive by the number of PRESET pulses

◆ During execution of the above INDEX drive, the CWLM and CCWLM signals function as follows:
- The CWLM and CCWLM signals function for "CWLM signal input function" and "CCWLM signal input function" defined by the SPEC INITIALIZE2 command.
- If the input function is the LIMIT stop function, the ORIGIN drive is finished after LIMIT is stopped.

■ ORIGIN drive parameters

You can use the ORIGIN SPEC command to select ORIGIN drive operation specifications as follows:

- Selecting the ORIGIN DRIVE start direction
- Selecting the detection method (edge/level) of the machine origin signal in the JOG process, which is the last process
- Selecting the operation specification applicable when a machine original signal level error occurs
  If a level error occurs, it operates in accordance with the selected operation specification.
  - ◆ If the Z phase, in which detection width is narrow, is used for the origin sensor, a level error may occur. To prevent this problem, set "Ignore level errors and proceed to the next process."
- Selecting whether to execute the INDEX drive to the address near the machine origin
- Selecting whether to enable the ERROR pulse detection function
- Selecting whether to output the DRST signal at completion of detection of the machine origin signal
  This function is valid when the DRST signal is set for <servo support> by the SERVO SPEC SET command.
- Selecting whether to quit the ORIGIN drive when the drive is stopped upon detection of a LIMIT stop signal (CWLM or CCWLM signal)
- Selecting an ORG composite signal



■ PRESET ORIGIN drive function

After the PRESET ORIGIN or SRATE PRESET ORIGIN drive is started, the machine origin detection drive ends normally and subsequently the drive is automatically performed to the position where PRESET PULSE is set.

◆ Parameter required for the PRESET ORIGIN drive
- PRESET PULSE : Number of PRESET pulses for the PRESET ORIGIN drive

■ Machine origin-near address setting function

The machine origin-near address is set according to the stored absolute address of the machine origin signal and the number of OFFSET pulses. When the ORIGIN, SRATE ORIGIN, PRESET ORIGIN, or SRATE PRESET ORIGIN drive is started, it moves to the machine origin-near address and then enters the machine origin detection process.

◆ Parameter required for the OFFSET drive
- OFFSET PULSE : Number of OFFSET pulses at the machine origin-near address

■ ERROR pulse detection function

If, during execution of the CONSTANT SCAN or JOG process, no detection signal can be detected and the number of output pulses reaches the maximum number by which error occurrence is determined, the ORIGIN drive is forcibly terminated.

If this function works, STATUS1 PORT ERROR is set to 1.

◆ Parameter required for error pulse setting for the CONSTANT SCAN process
- CSCAN ERROR PULSE: Maximum number of pulses by which an error is determined in the CONSTANT SCAN process

◆ Parameter required for error pulse setting for the JOG process
- JOG ERROR PULSE : Maximum number of pulses by which an error is determined in the JOG process

■ MARGIN pulses

Set the number of MARGIN pulses for the overtravel after detection of the machine origin.

Insert MARGIN pulses in the SCAN or CONSTANT SCAN process. When the machine origin signal is detected in the CONSTANT SCAN process, it advances in the running direction by the number of MARGIN pulses and then stops.

In the SCAN process, if the amount of travel from the detection of the machine origin signal to the stop position is less than the number of MARGIN pulses, it advances by the number of MARGIN pulses.

◆ The MARGIN pulses are not inserted in the NORG detection process and the final process of the ORIGIN drive.

◆ Set the number of MARGIN pulses as follows:
- ORIGIN DELAY SET : Set the number of MARGIN pulses for the overtravel after detection of the machine origin.

■ DELAY TIME

Insert DELAY TIME when the each ORIGIN drive process (LIMIT, SCAN, JOG) reverses. Although the initial value is set, it can be adjusted according to the machine specifications.
Do not insert DELAY TIME if it is 0.

◆ If the DEND signal is enabled by the SERVO SPEC SET command, insert DELAY TIME after completion of the DEND signal.
◆ Set the ORIGIN DELAY using the following command:
  ・ORIGIN DELAY SET : Set DELAY TIME when each ORIGIN drive process reverses.

■ Setting parameters for the ORIGIN drive selection function

(Dashed box) Do this operation when the initial value or the parameter value that has been set needs to be changed.

OFFSET PULSE SET command	This command is enabled when ORIGIN FLG ENABLE of ORIGIN SPEC SET is 1. Set the number of OFFSET pulses of a machine origin-near address.
CSCAN ERROR PULSE SET command	This command is enabled when ERROR PULSE ENABLE of ORIGIN SPEC SET is 1. Set the maximum number of pulses by which an error in the CONSTANT SCAN process is determined.
JOG ERROR PULSE SET command	This command is enabled when ERROR PULSE ENABLE of ORIGIN SPEC SET is 1. Set the maximum number of pulses by which an error in the JOG process is determined.

■ ORIGIN drive execution sequence

Set drive function parameters	① Set the parameters required for the acceleration/deceleration drive.
ORIGIN SPEC SET command	② Set the operation specifications for the ORIGIN drive.
ORIGIN CSPD SET command	③ Set the pulse speed of the CONSTANT SCAN process.
ORIGIN DELAY SET command	④ Set the DELAY TIME between individual drive processes, and the number of MARGIN pulses after detection of the machine origin signal.
Execute drive	⑤ Execute the ORIGIN drive.

■ PRESET ORIGIN drive execution sequence

Set drive function parameters	① Set the parameters required for the acceleration/deceleration drive.
ORIGIN SPEC SET command	② Set the operation specifications for the ORIGIN drive.
ORIGIN CSPD SET command	③ Set the pulse speed of the CONSTANT SCAN process.
ORIGIN DELAY SET command	④ Set the DELAY TIME between individual drive processes, and the number of MARGIN pulses after detection of the machine origin signal.
PRESET PULSE SET command	⑤ Set the number of PRESET pulses for the PRESET ORIGIN drive.
Execute drive	⑥ Execute the PRESET ORIGIN drive.

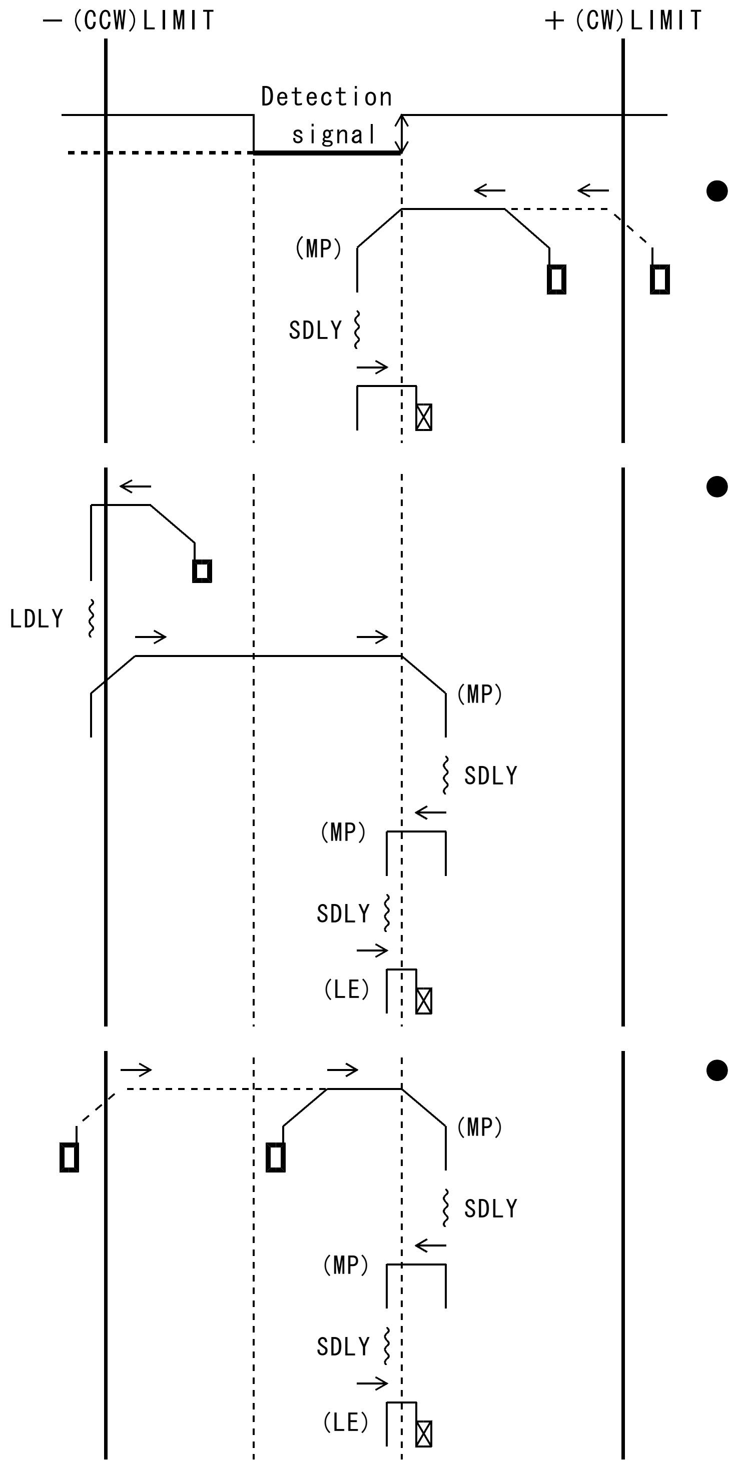
(1) ORG-0 drive type

■When the ORIGIN drive starts in the - (CCW) direction

With the ORG-0 type in the CCW direction, the machine origin is detected upon detection of a CW-side edge of the ORG detection signal.

Input a single pulse or a - (CCW) level holding sensor signal to the ORG detection signal.

Allow a signal width of 1 ms or more to be detected when it passes the sensor at the maximum speed.



□ Start position (MP)：MARGIN pulse insertion
⊠ End position (LE)：Level error check

● When the start position is on the CW side

① Perform the SCAN process.
Slow down and stop upon detection of the CW-side edge of the detection signal.

② Insert SCAN DELAY TIME.

③ Perform the CONSTANT SCAN process.
Stop upon detection of the CW-side edge of the detection signal.

● When the start position is on the CCW side

① Perform the SCAN process.
Stop upon detection of the CCWLM signal.

② Insert LIMIT DELAY TIME.

③ Perform the SCAN process.
Slow down and stop upon detection of the CW-side edge of the detection signal.

④ Insert SCAN DELAY TIME.

⑤ Perform the CONSTANT SCAN process.
Stop upon detection of the CW-side edge of the detection signal.

⑥ Insert SCAN DELAY TIME.

⑦ Perform the CONSTANT SCAN process.
Stop upon detection of the CW-side edge of the detection signal.

● When the start position is in the sensor or CCW LIMIT

① Perform the SCAN process.
Slow down and stop upon detection of the CW-side edge of the detection signal.

② Insert SCAN DELAY TIME.

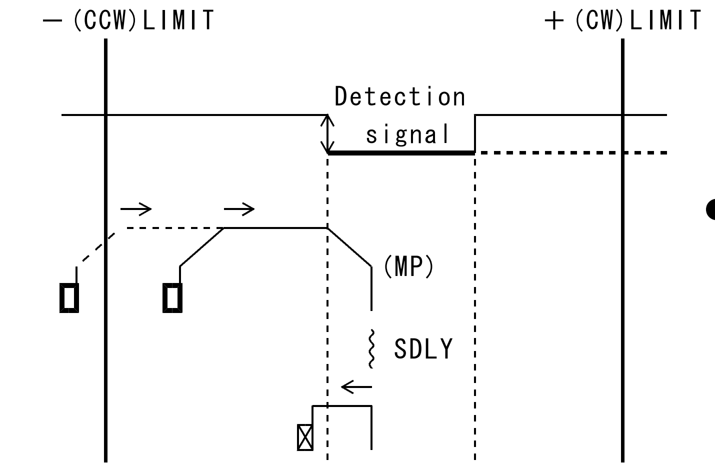
③ Perform the CONSTANT SCAN process.
Stop upon detection of the CW-side edge of the detection signal.

④ Insert SCAN DELAY TIME.

⑤ Perform the CONSTANT SCAN process.
Stop upon detection of the CW-side edge of the detection signal.

■When the ORIGIN drive start direction is the + (CW) direction

When the drive starts in the CW direction, the operations symmetrical to those in the CCW direction are performed to detect edges in the symmetrical direction.



□ Start position (MP)：MARGIN pulse insertion
⊠ End position (LE)：Level error check

● Example in which the start position is on the CCW side

① Perform the SCAN process.
Slow down and stop upon detection of the CCW-side edge of the detection signal.

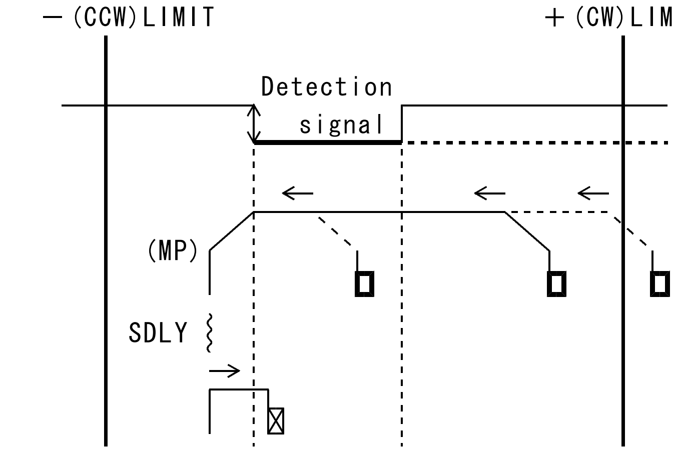
② Insert SCAN DELAY TIME.

③ Perform the CONSTANT SCAN process.
Stop upon detection of the CCW-side edge of the detection signal.

(2) ORG-1 drive type

■ When the ORIGIN drive starts in the - (CCW) direction

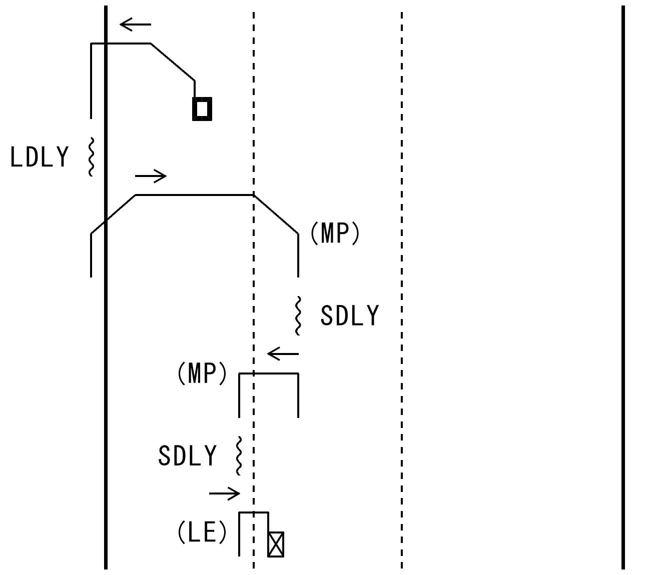
With the ORG-1 type in the CCW direction, the machine origin is detected upon detection of a CW-side edge of the ORG detection signal.
Input a single pulse or a + (CW) level holding sensor signal to the ORG detection signal.
Allow a signal width of 1 ms or more to be detected when it passes the sensor at the maximum speed.



□ Start position (MP): MARGIN pulse insertion
⊠ End position (LE): Level error check

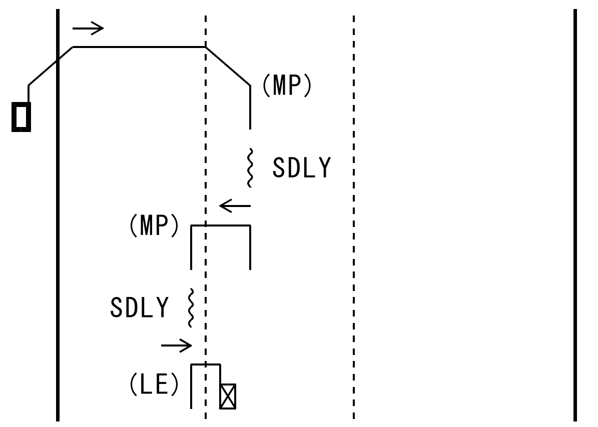
● When the start position is on the CW side

① Perform the SCAN process.
Slow down and stop upon detection of the CCW-side edge of the detection signal.
② Insert SCAN DELAY TIME.
③ Perform the CONSTANT SCAN process.
Stop upon detection of the CCW-side edge of the detection signal.



● When the start position is on the CCW side

① Perform the SCAN process.
Stop upon detection of the CCWLM signal.
② Insert LIMIT DELAY TIME.
③ Perform the SCAN process.
Slow down and stop upon detection of the CCW-side edge of the detection signal.
④ Insert SCAN DELAY TIME.
⑤ Perform the CONSTANT SCAN process.
Stop upon detection of the CCW-side edge of the detection signal.
⑥ Insert SCAN DELAY TIME.
⑦ Perform the CONSTANT SCAN process.
Stop upon detection of the CCW-side edge of the detection signal.

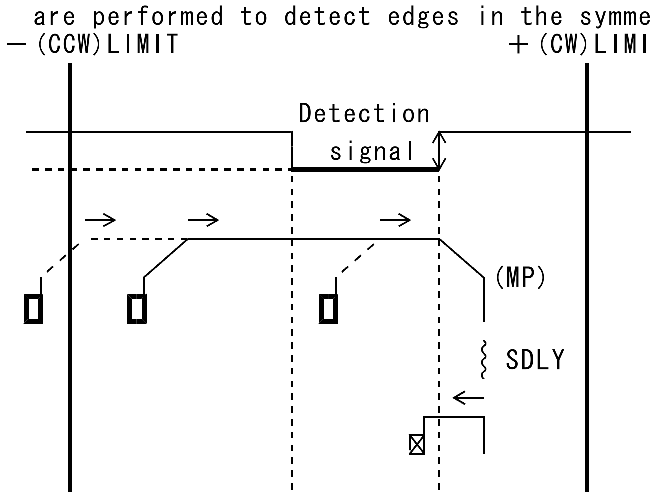


● When the start position is in the CCW LIMIT

① Perform the SCAN process.
Slow down and stop upon detection of the CCW-side edge of the detection signal.
② Insert SCAN DELAY TIME.
③ Perform the CONSTANT SCAN process.
Stop upon detection of the CCW-side edge of the detection signal.
④ Insert SCAN DELAY TIME.
⑤ Perform the CONSTANT SCAN process.
Stop upon detection of the CCW-side edge of the detection signal.

■ When the ORIGIN drive start direction is the + (CW) direction

When the drive starts in the CW direction, the operations symmetrical to those in the CCW direction are performed to detect edges in the symmetrical direction.



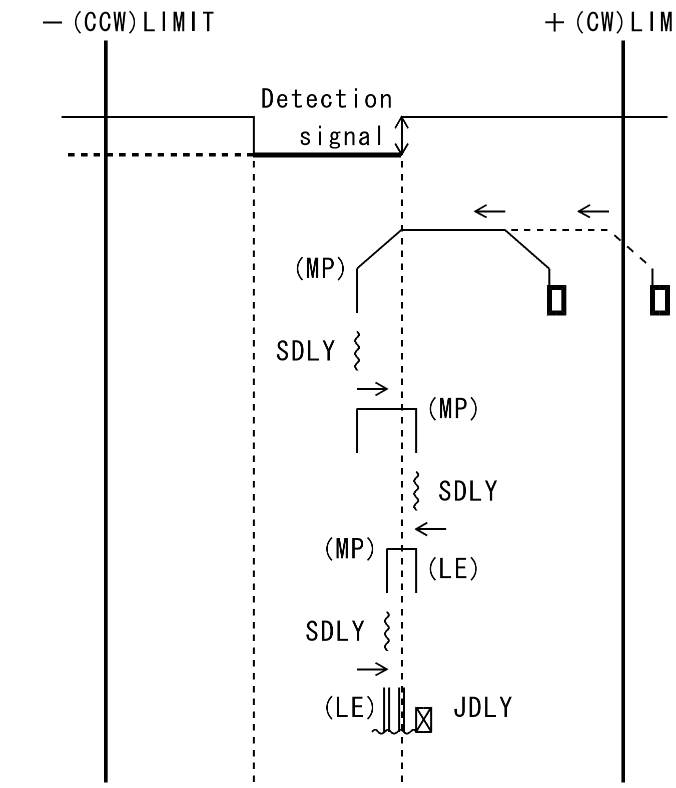
□ Start position (MP): MARGIN pulse insertion
⊠ End position (LE): Level error check

● Example in which the start position is on the CCW side

① Perform the SCAN process.
Slow down and stop upon detection of the CW-side edge of the detection signal.
② Insert SCAN DELAY TIME.
③ Perform the CONSTANT SCAN process.
Stop upon detection of the CW-side edge of the detection signal.

(3) ORG-2 drive type

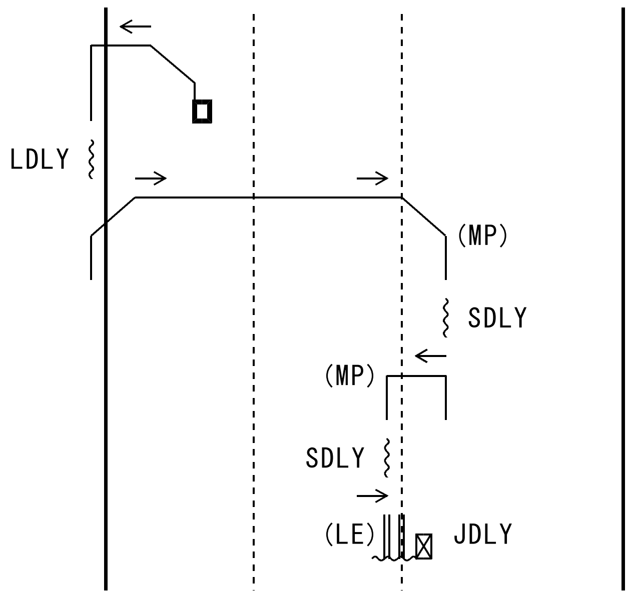
The following explanation assumes that the ORIGIN drive start direction is on the - (CCW) direction.
The ORG-2 drive type is the ORG-0 type to which the JOG process is added to improve precision.



□ Start position (MP)：MARGIN pulse insertion
⊠ End position (LE)：Level error check

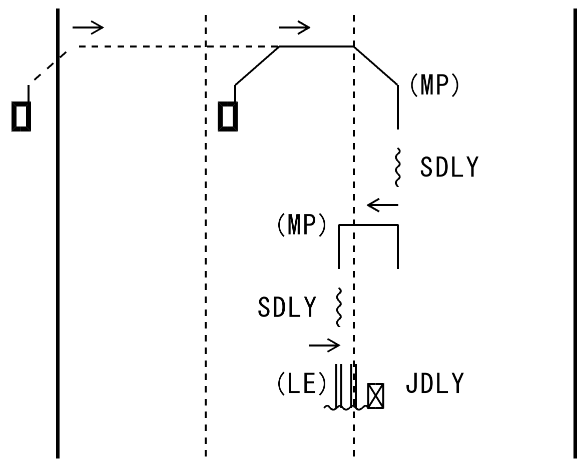
● When the start position is on the CW side

① Perform the SCAN process.
Slow down and stop upon detection of the CW-side edge of the detection signal.
② Insert SCAN DELAY TIME.
③ Perform the CONSTANT SCAN process.
Stop upon detection of the CW-side edge of the detection signal.
④ Insert SCAN DELAY TIME.
⑤ Perform the CONSTANT SCAN process.
top upon detection of the CW-side edge of the detection signal.
⑥ Insert SCAN DELAY TIME.
⑦ Perform the JOG process.
Stop upon detection of the CW-side edge of the detection signal.



● When the start position is on the CCW side

① Perform the SCAN process.
Stop upon detection of the CCWLM signal.
② Insert LIMIT DELAY TIME.
③ Perform the SCAN process.
Slow down and stop upon detection of the CW-side edge of the detection signal.
④ Insert SCAN DELAY TIME.
⑤ Perform the CONSTANT SCAN process.
Stop upon detection of the CW-side edge of the detection signal.
⑥ Insert SCAN DELAY TIME.
⑦ Perform the JOG process.
Stop upon detection of the CW-side edge of the detection signal.

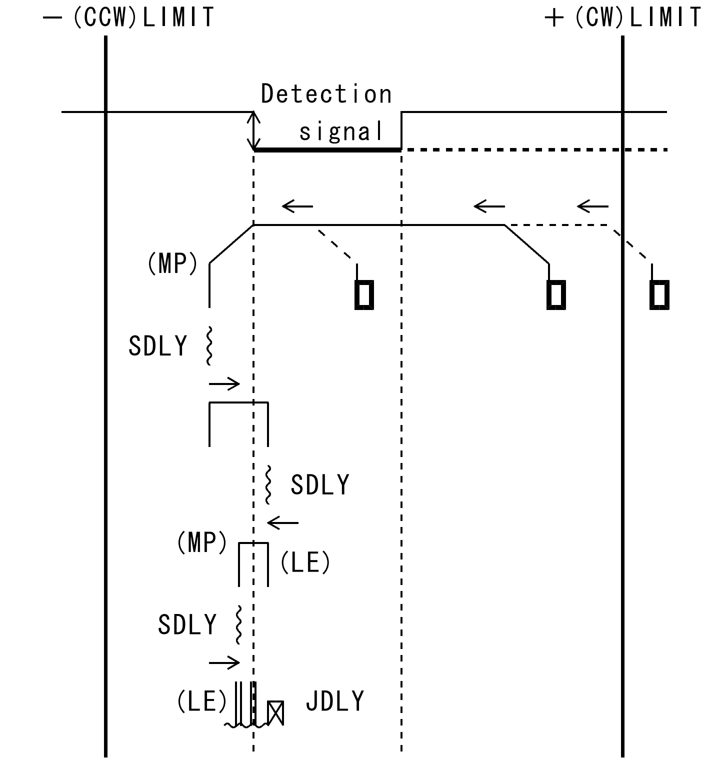


● When the start position is in the sensor or CCW LIMIT

① Perform the SCAN process.
Slow down and stop upon detection of the CW-side edge of the detection signal.
② Insert SCAN DELAY TIME.
③ Perform the CONSTANT SCAN process.
Stop upon detection of the CW-side edge of the detection signal.
④ Insert SCAN DELAY TIME.
⑤ Perform the JOG process.
Stop upon detection of the CW-side edge of the detection signal.

(4) ORG-3 drive type

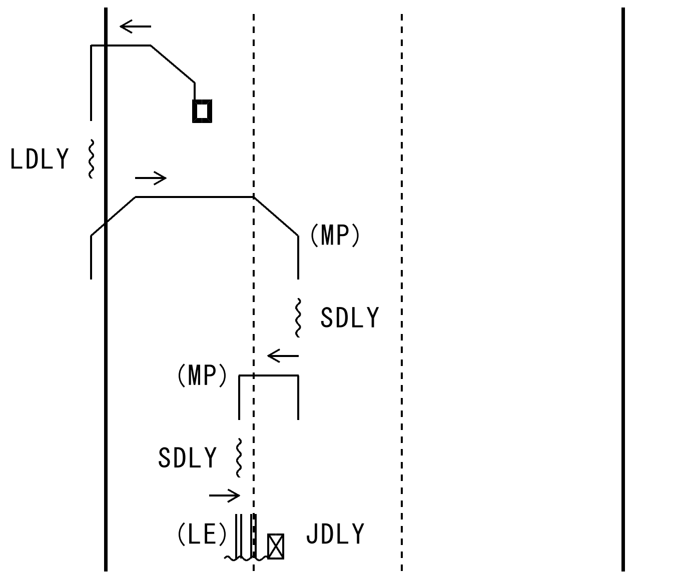
The following explanation assumes that the ORIGIN drive start direction is on the - (CCW) direction.
The ORG-3 drive type is the ORG-1 type to which the JOG process is added to improve precision.



▯ Start position (MP) : MARGIN pulse insertion
⊠ End position (LE) : Level error check

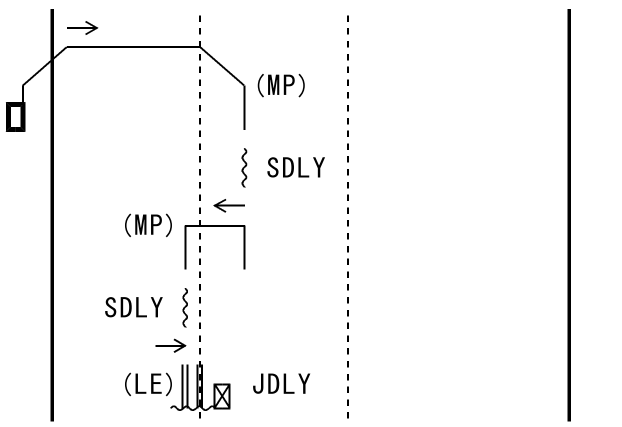
● When the start position is on the CW side

① Perform the SCAN process.
Slow down and stop upon detection of the CCW-side edge of the detection signal.
② Insert SCAN DELAY TIME.
③ Perform the CONSTANT SCAN process.
Stop upon detection of the CCW-side edge of the detection signal.
④ Insert SCAN DELAY TIME.
⑤ Perform the CONSTANT SCAN process.
Stop upon detection of the CCW-side edge of the detection signal.
⑥ Insert SCAN DELAY TIME.
⑦ Perform the JOG process.
Stop upon detection of the CCW-side edge of the detection signal.



● When the start position is on the CCW side

① Perform the SCAN process.
Stop upon detection of the CCWLM signal.
② Insert LIMIT DELAY TIME.
③ Perform the SCAN process.
Slow down and stop upon detection of the CCW-side edge of the detection signal.
④ Insert SCAN DELAY TIME.
⑤ Perform the CONSTANT SCAN process.
Stop upon detection of the CCW-side edge of the detection signal.
⑥ Insert SCAN DELAY TIME.
⑦ Perform the JOG process.
Stop upon detection of the CCW-side edge of the detection signal.



● When the start position is in the CCW LIMIT

① Perform the SCAN process.
Slow down and stop upon detection of the CCW-side edge of the detection signal.
② Insert SCAN DELAY TIME.
③ Perform the CONSTANT SCAN process.
Stop upon detection of the CCW-side edge of the detection signal.
④ Insert SCAN DELAY TIME.
⑤ Perform the JOG process.
Stop upon detection of the CCW-side edge of the detection signal.

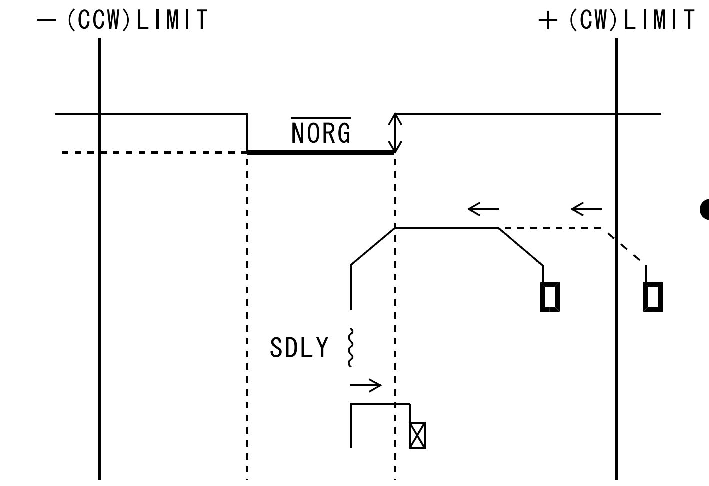
(5) **ORG-4 and ORG-5 drive types**

With the ORG-4 or ORG-5 type, the machine origin is detected upon detection of a NORG and ORG detection signals.
The ORG-4 or ORG-5 type first executes the NEAR ORIGIN process and then executes the ORIGIN process.

■ NEAR ORIGIN process of ORG-4 and ORG-5 types

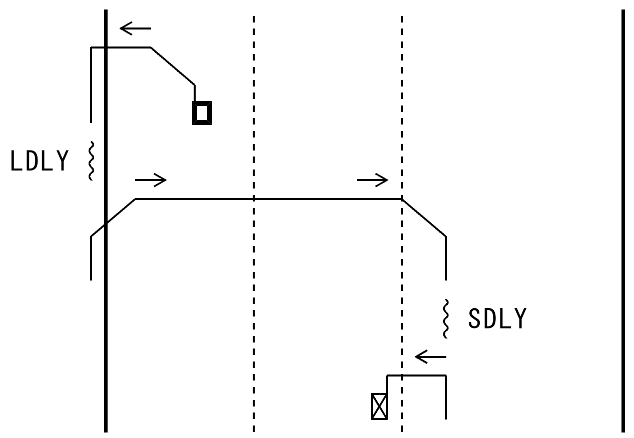
The following explanation assumes that the ORIGIN drive starts in the - (CCW) direction.
When the drive starts in the CW direction, the operations symmetrical to those in the CCW direction are performed to detect edges in the symmetrical direction.

Input a single pulse or a - (CCW) level holding sensor signal to the NORG detection signal.
Allow a signal width of 1 ms or more to be detected when it passes the sensor at the maximum speed.

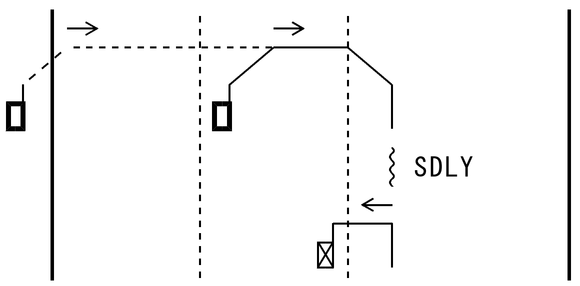


□ Start position (MP): MARGIN pulse insertion
⊠ End position (LE): Level error check

● When the start position is on the CW side
① Perform the SCAN process.
Slow down and stop upon detection of the CW-side edge of the detection signal.
② Insert SCAN DELAY TIME.
③ Perform the CONSTANT SCAN process.
Stop upon detection of the CW-side edge of the detection signal.



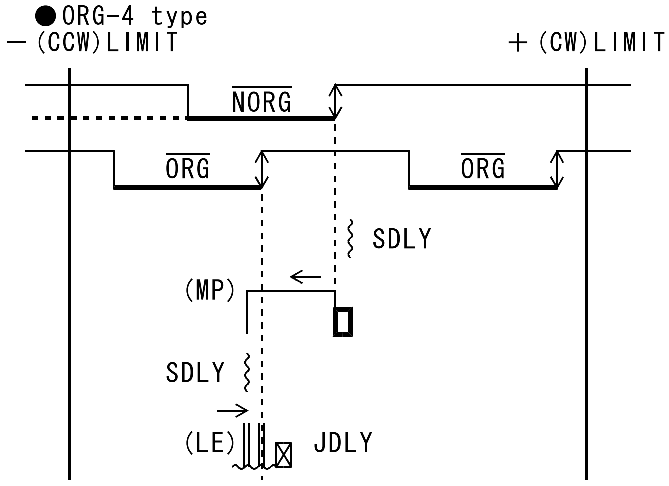
● When the start position is on the CCW side
① Perform the SCAN process.
Stop upon detection of the CCWLM signal.
② Insert LIMIT DELAY TIME.
③ Perform the SCAN process.
Slow down and stop upon detection of the CW-side edge of the detection signal.
④ Insert SCAN DELAY TIME.
⑤ Perform the CONSTANT SCAN process.
Stop upon detection of the CW-side edge of the detection signal.



● When the start position is in the sensor or CCW LIMIT
① Perform the SCAN process.
Slow down and stop upon detection of the CW-side edge of the detection signal.
② Insert SCAN DELAY TIME.
③ Perform the CONSTANT SCAN process.
Stop upon detection of the CW-side edge of the detection signal.

■ORIGIN process
The following explanation assumes that the ORIGIN drive starts in the - (CCW) direction.
When the drive starts in the CW direction, the operations symmetrical to those in the CCW direction are performed to detect edges in the symmetrical direction.
Input into the ORG detection signal a sensor signal that is periodically generated such as by a slit of a rotary axis.
Allow a signal width of 1 ms or more to be detected when it passes the sensor at the speed (CSPD) in the CONSTANT SCAN process.

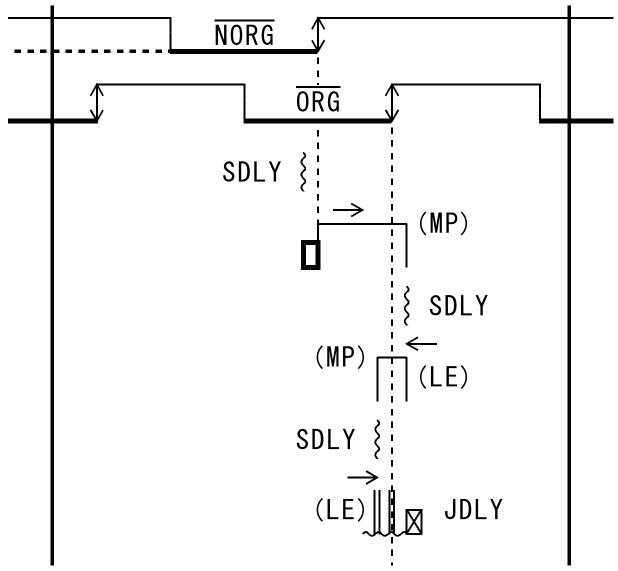
●ORG-4 type



□ Start position (MP)：MARGIN pulse insertion
⊠ End position (LE)：Level error check

● If ORG is not active when NORG is detected

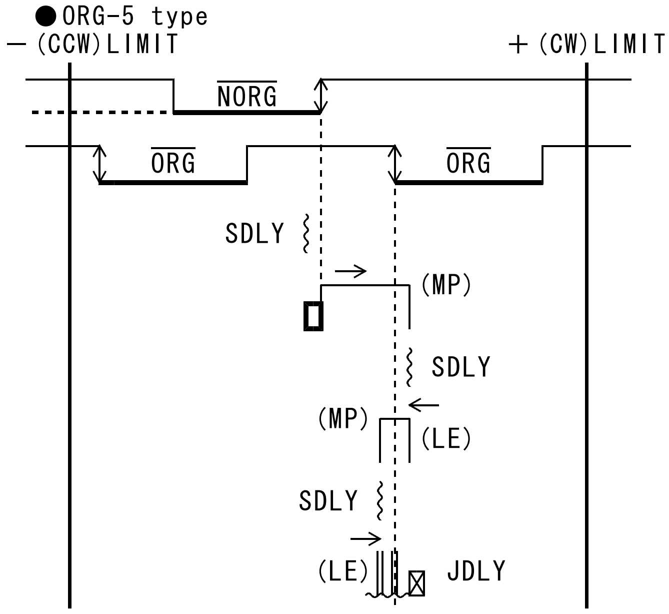
① Insert SCAN DELAY TIME.
② Perform the CONSTANT SCAN process.
Stop upon detection of the CW-side edge of the detection signal.
③ Insert SCAN DELAY TIME.
④ Perform the JOG process.
Stop upon detection of the CW-side edge of the detection signal.



● If ORG is active when NORG is detected

① Insert SCAN DELAY TIME.
② Perform the CONSTANT SCAN process.
Stop upon detection of the CW-side edge of the detection signal.
③ Insert SCAN DELAY TIME.
④ Perform the CONSTANT SCAN process.
Stop upon detection of the CW-side edge of the detection signal.
⑤ Insert SCAN DELAY TIME.
⑥ Perform the JOG process.
Stop upon detection of the CW-side edge of the detection signal.

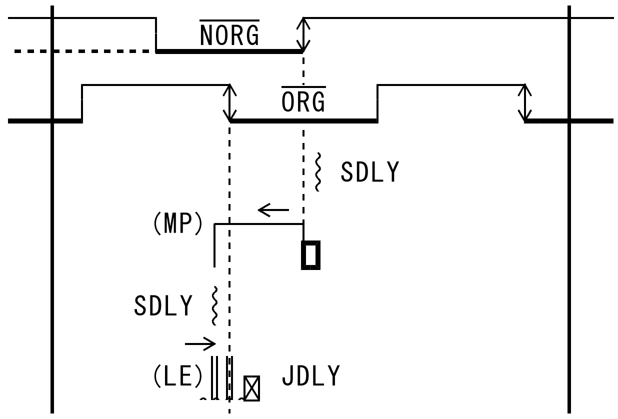
●ORG-5 type



□ Start position (MP)：MARGIN pulse insertion
⊠ End position (LE)：Level error check

● If ORG is not active when NORG is detected

① Insert SCAN DELAY TIME.
② Perform the CONSTANT SCAN process.
Stop upon detection of the CCW-side edge of the detection signal.
③ Insert SCAN DELAY TIME.
④ Perform the CONSTANT SCAN process.
Stop upon detection of the CCW-side edge of the detection signal.
⑤ Insert SCAN DELAY TIME.
⑥ Perform the JOG process.
Stop upon detection of the CCW-side edge of the detection signal.



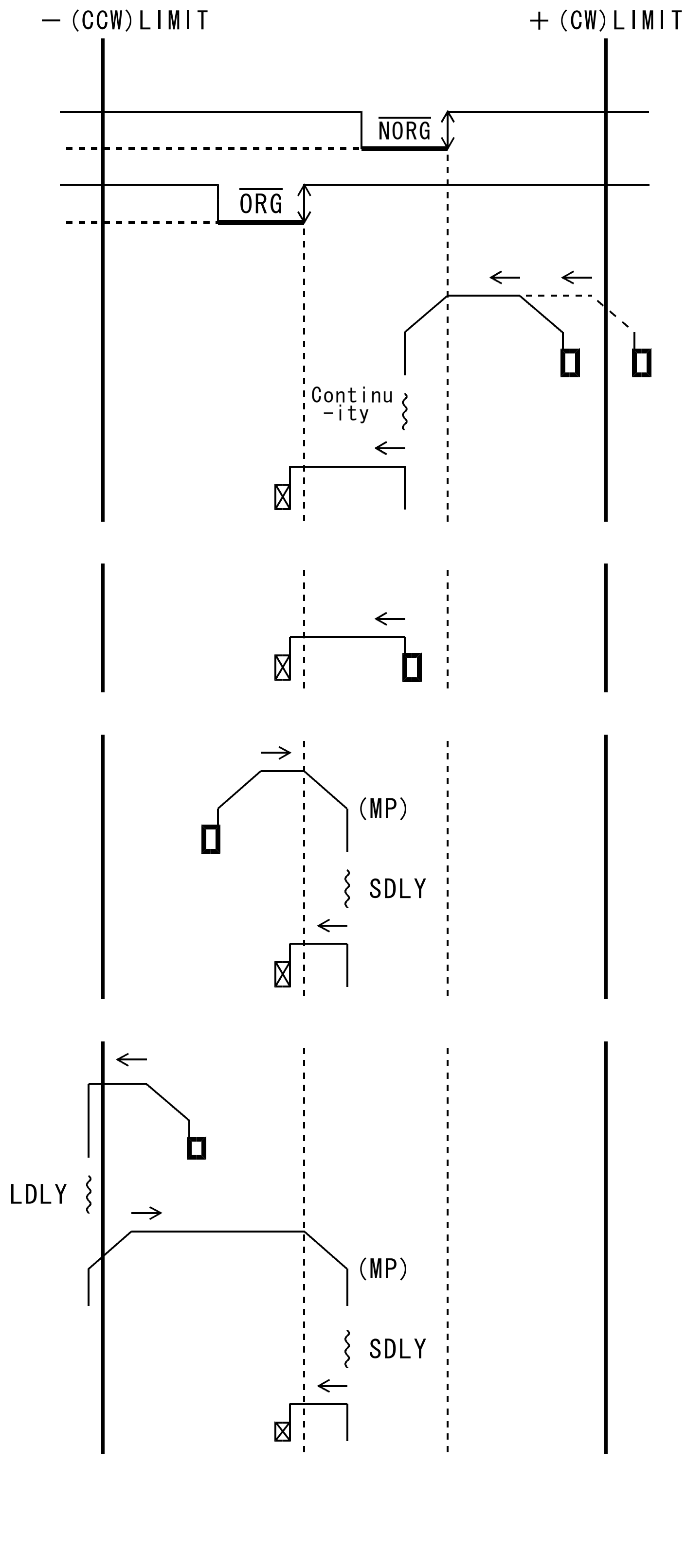
● If ORG is active when NORG is detected

① Insert SCAN DELAY TIME.
② Perform the CONSTANT SCAN process.
Stop upon detection of the CCW-side edge of the detection signal.
③ Insert SCAN DELAY TIME.
④ Perform the JOG process.
Stop upon detection of the CCW-side edge of the detection signal.

(6) ORG-10 drive type

The following explanation assumes that the ORIGIN drive starts in the - (CCW) direction.
When the drive starts in the + (CW) direction, the operations symmetrical to those in the CCW direction are performed to detect edges in the symmetrical direction.

With the ORG-10 type, the machine origin is detected upon detection of a NORG and ORG detection signals.
Input a single pulse or a - (CCW) level holding sensor signal to the NORG detection signal.
Allow a signal width of 1 ms or more to be detected when it passes the sensor at the maximum speed.



□ Start position (MP)：MARGIN pulse insertion
⊠ End position (LE)：Level error check

● When the start position is on the CW side
① Perform the SCAN process.
Slow down and stop upon detection of the CW-side edge of the detection signal.
② Don't insert DELAY TIME.
③ Perform the CONSTANT SCAN process.
Stop upon detection of the CW-side edge of the detection signal.

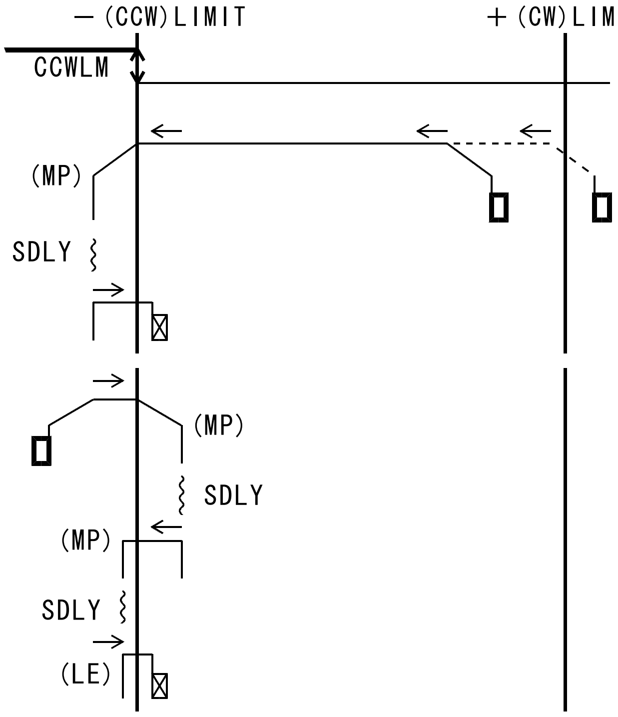
● When the start position is in the NORG sensor
① Perform the CONSTANT SCAN process.
Stop upon detection of the CW-side edge of the detection signal.

● When the start position is in the ORG sensor
① Perform the SCAN process.
Slow down and stop upon detection of the CW-side edge of the detection signal.
② Insert SCAN DELAY TIME.
③ Perform the CONSTANT SCAN process.
Stop upon detection of the CW-side edge of the detection signal.

● When the start position is outside the ORG sensor on the CCW side
① Perform the SCAN process.
Stop upon detection of the CCWLM signal.
② Insert LIMIT DELAY TIME.
③ Perform the SCAN process.
Slow down and stop upon detection of the CW-side edge of the detection signal.
④ Insert SCAN DELAY TIME.
⑤ Perform the CONSTANT SCAN process.
Stop upon detection of the CW-side edge of the detection signal.

(7) ORG-11 drive type

When the drive starts in the CCW direction, the machine origin is detected upon detection of a CW-side edge of the CCWLM signal.
When the drive starts in the CW direction, the machine origin is detected upon detection of a CCW-side edge of the CCWLM signal.
The following explanation assumes that the ORIGIN drive starts in the - (CCW) direction.
When the drive starts in the + (CW) direction, the operations symmetrical to those in the CCW direction are performed to detect the machine origin.
Input a single pulse or a - (CCW) level holding sensor signal to the CCWLM signal.
Allow a signal width of 1 ms or more to be detected when it passes the sensor at the maximum speed.
In the SCAN process, the stop function after detection of the CCWLM signal is slow stop.
The distance from the CCWLM signal to the system limit in the - (CCW) direction must be sufficient for slow stop.



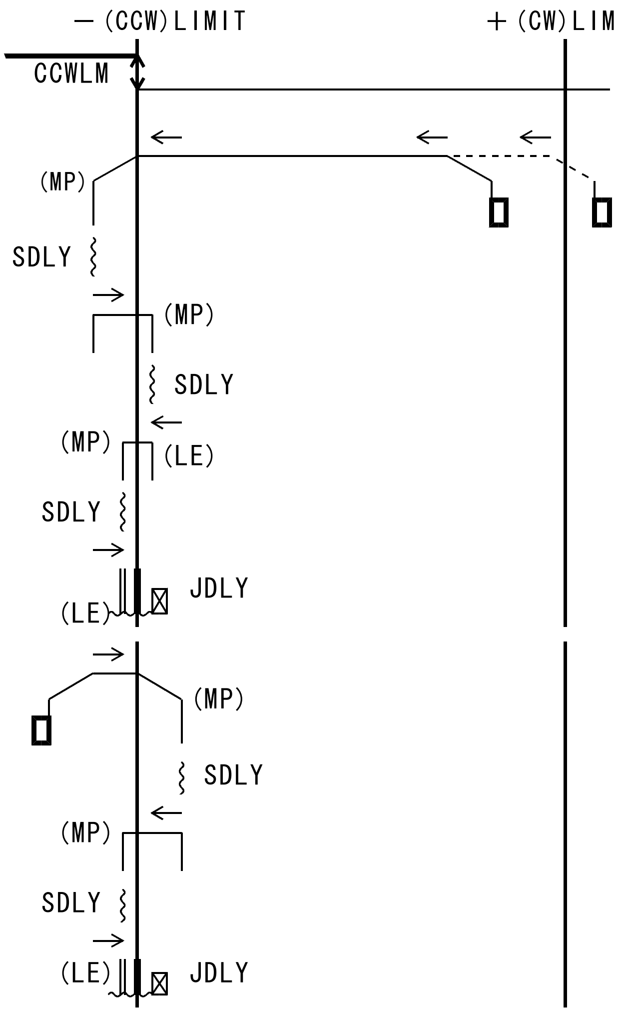
□ Start position (MP)：MARGIN pulse insertion
⊠ End position (LE)：Level error check

● When the start position is on the CW side
① Perform the SCAN process.
Slow down and stop upon detection of the CW-side edge of the detection signal.
② Insert SCAN DELAY TIME.
③ Perform the CONSTANT SCAN process.
Stop upon detection of the CW-side edge of the detection signal.

● When the start position is in the CCW LIMIT
① Perform the SCAN process.
Slow down and stop upon detection of the CW-side edge of the detection signal.
② Insert SCAN DELAY TIME.
③ Perform the CONSTANT SCAN process.
Stop upon detection of the CW-side edge of the detection signal.
④ Insert SCAN DELAY TIME.
⑤ Perform the CONSTANT SCAN process.
Stop upon detection of the CW-side edge of the detection signal.

(8) ORG-12 drive type

When the drive starts in the CCW direction, the machine origin is detected upon detection of a CW-side edge of the CCWLM signal.
When the drive starts in the CW direction, the machine origin is detected upon detection of a CCW-side edge of the CCWLM signal.
The following explanation assumes that the ORIGIN drive starts in the - (CCW) direction.
The ORG-12 drive type is the ORG-11 type to which the JOG process is added to improve precision.



□ Start position (MP)：MARGIN pulse insertion
⊠ End position (LE)：Level error check

● When the start position is on the CW side
① Perform the SCAN process.
Slow down and stop upon detection of the CW-side edge of the detection signal.
② Insert SCAN DELAY TIME.
③ Perform the CONSTANT SCAN process.
Stop upon detection of the CW-side edge of the detection signal.
④ Insert SCAN DELAY TIME.
⑤ Perform the CONSTANT SCAN process.
Stop upon detection of the CW-side edge of the detection signal.
⑥ Insert SCAN DELAY TIME.
⑦ Perform the JOG process.
Stop upon detection of the CW-side edge of the detection signal.

● When the start position is in the CCW LIMIT
① Perform the SCAN process.
Slow down and stop upon detection of the CW-side edge of the detection signal.
② Insert SCAN DELAY TIME.
③ Perform the CONSTANT SCAN process.
Stop upon detection of the CW-side edge of the detection signal.
④ Insert SCAN DELAY TIME.
⑤ Perform the JOG process.
Stop upon detection of the CW-side edge of the detection signal.

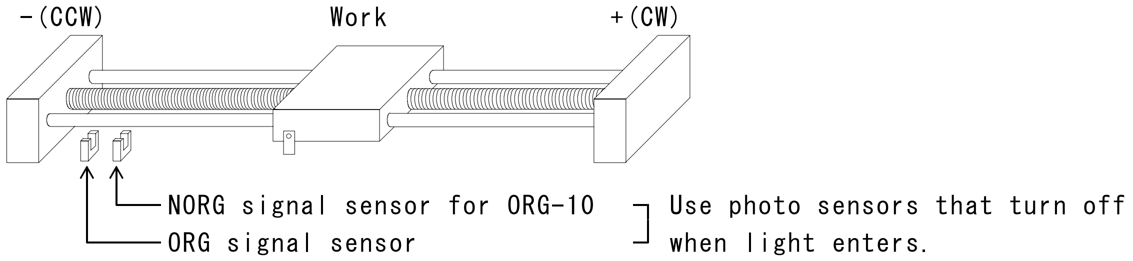
(9) Requirements for machine origin detection

■Sensor arrangement

●For ORG-0, ORG-1, ORG-2, ORG-3, and ORG-10

Mount the NORG and ORG signal sensors on the - (CCW) LIMIT side along the work moving direction.

Example: Ball screw table



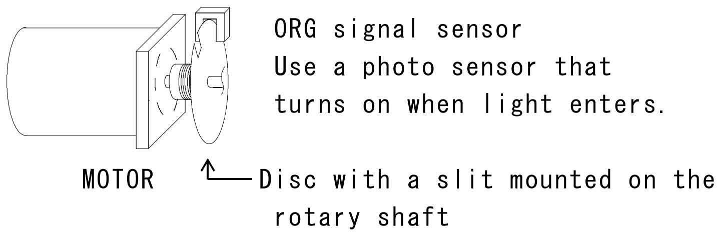
●For ORG-4 and ORG-5

・Mount the NORG signal sensor on the - (CCW) LIMIT side along the ball screw work moving direction.

・ORG signal sensor

◆When using a stepping motor

Mount this sensor on the rotary shaft of the motor.



※ With ORG-4 or ORG-5, the ORG sensor and PO (phase output) signal of the stepping motor driver can be used (According to the AND (conjunction) signal of the ORG and PO signals) to enable accurate origin detection. Make arrangement so that the PO signal enters once while the ORG signal (rotary slit width) is active.

◆When using a servo motor

Input the encoder Z phase (C φ), instead of the ORG signal, to the +ZORG and -ZORG signals, and leave the ORG signal input disconnected. Secure 10μs or more for the pulse width of the encoder Z phase (C φ) output.

●For ORG-11 and ORG-12

・These types use the LIMIT signal as the origin signal and therefore require the LIMIT sensor alone.

■Other requirements

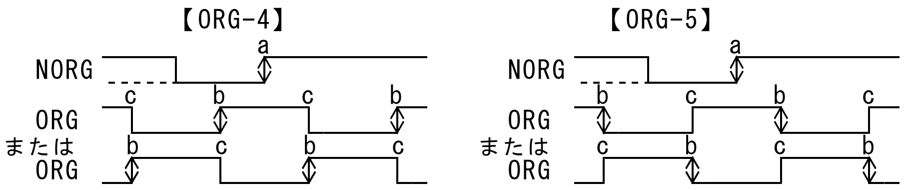
・The sensors used must support interfacing at +24 V.

・The ORG signal, NORG signal, and the LIMIT signal used as an origin sensor must be free of chattering. (When photo sensors are used, chattering makes no problems.)

・The sensor signal must be detected for 1 ms or more when the object passes the sensor at the maximum speed.

・For the encoder Z phase (C φ) output, use that from the line driver output circuit, and secure 10μs or more for the input signal width of +ZORG and -ZORG.

・For the ORG-4 and ORG-5 types, the distance between point a and point b and the distance between point a and point c should be N pulses or more in terms of the number of pulses.



N=0.002×CSPD(Hz)
［Minimum value of N is 1. ］

Example) When CSPD＝5KHz
N=0.002×5,000=10pulses
Practically, give some allowance to it.

・If +ZORG and -ZORG signals are input, the ORG signal must be disconnected.
If the ORG signal is input, the +ZORG and -ZORG signals must be disconnected.
(The ORG and +ZORG and -ZORG signals cannot be used concurrently.)

8-7. Executing Interpolation Drive

For the interpolation drive, basic acceleration/deceleration pulses are interpolated and calculated to output interpolation pulses from individual axes. Basic acceleration/deceleration pulses are generated by the drive parameters that are set for the main axis (X or Z axis). A slow stop command or immediate stop command is valid regardless of the X and Y (or Z and A) axis from which it is generated.

・When a slow stop command is detected, basic acceleration/deceleration pulses are slowed down and stopped to end the interpolation drive.

・When an immediate stop command is detected, interpolation pulse output is immediately stopped to end the interpolation drive.

◆ If the DEND or DRST signal is set for <servo support>, interpolation drive ends after <servo support> of both axes ends.

◆ END PULSE drive is also valid for the 2-axis linear interpolation drive.
The basic acceleration/deceleration pulses for the interpolation drive perform the END PULSE drive.

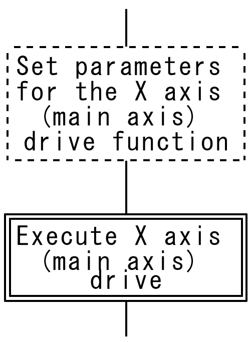
◆ For the 2-axis circular interpolation drive, the END PULSE drive is enabled if the end-point correction drive is not performed.
By default the execution of interpolation drive is enabled (END PULSE drive is disabled).

◆ The SOFT LIMIT function is also valid for the interpolation drive.
When the SOFT LIMIT address is detected, that slows down and stops at the SOFT LIMIT address of the axis where it was detected, and ends the interpolation drive.

(1) 2-axis linear interpolation drive

2-axis linear interpolation drive, and 2-axis linear interpolation drive under linear speed constant control can be performed.
Linear interpolation is performed toward the specified coordinates from the current coordinates.
Positional errors for the specified straight line are ±0.5LSB.
The absolute and relative addresses that can be specified for coordinates range from -2,147,483,647 to +2,147,483,647 (32 bits).
As with INDEX drive, asymmetrical acceleration/deceleration drive can be used for positioning.

■ Linear interpolation drive execution sequence

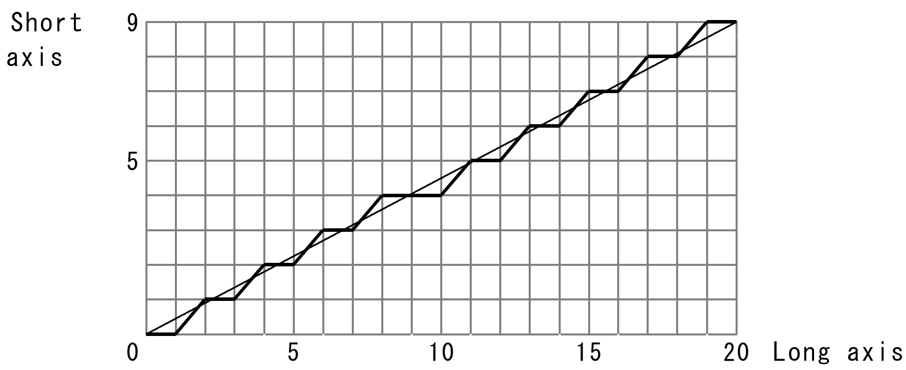


① Set necessary parameters required for acceleration/deceleration drive for the main axis (X or Z axis).

② Execute main axis (X or Z axis) drive.

Dashed box: Do this operation when the initial value or the parameter value that has been set needs to be changed.

■Locus of linear interpolation drive (example of long axis 20 and short axis 9)



The locus of linear interpolation drive runs along the straight line between the current location and destination.
When the END PULSE drive is set so that it moves in the direction opposite to the start direction, the system passes the destination by the END PULSE and stops, and then returns on the same locus as that it passed when it went, until it stops at the destination.

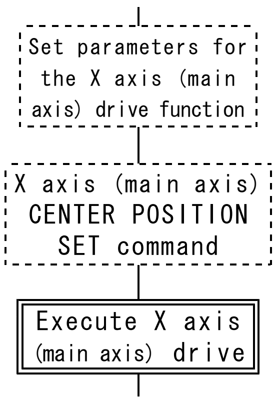
◆ Long axis and short axis of linear interpolation: The axis involving more interpolation pulses is the long axis, and the one involving fewer interpolation pulses is the short axis.

◆ The 2-axis linear interpolation drive requires parameters to be set for X axis (main axis) linear acceleration/deceleration or S-curve acceleration/deceleration drive.

(2) 2-axis circular interpolation drive

2-axis circular interpolation drive, and 2-axis circular interpolation drive under linear speed constant control can be performed.
Circular interpolation is performed toward the specified coordinates from the current coordinates on the circular curve specified by the center-point or passing-point coordinates.
Positional errors for the specified circuit curve are ±1 LSB for center-point circular interpolation or ±2 LSB for passing-point interpolation.
The absolute addresses that can be specified for coordinates range from -2,147,483,647 to +2,147,483,647 (32 bits).
The relative addresses that can be specified for coordinates range from -8,388,607 to +8,388,607 (24 bits).
As with INDEX drive, asymmetrical acceleration/deceleration drive can be used for positioning.

■ Execution sequence of center-point circular interpolation drive

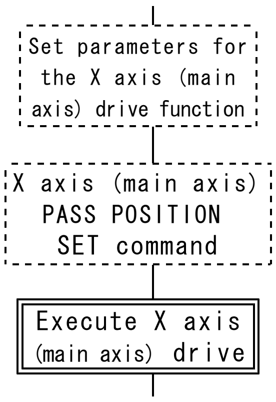


① Set necessary parameters required for acceleration/deceleration drive for the main axis (X or Z axis).

② Set the circular center point address for the main axis (X or Z axis).

③ Execute main axis (X or Z axis) drive.

■ Execution sequence of passing-point circular interpolation drive

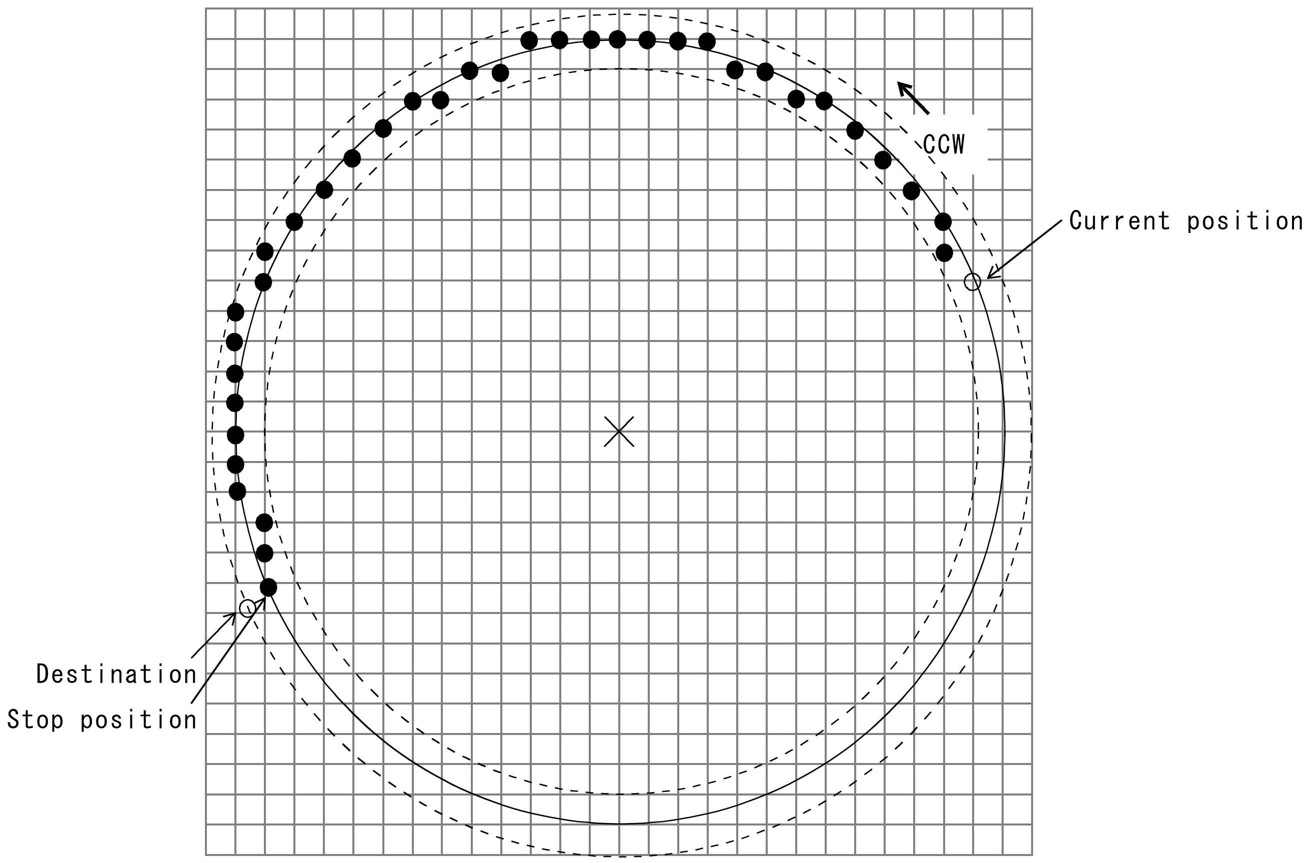


① Set necessary parameters required for acceleration/deceleration drive for the main axis (X or Z axis).

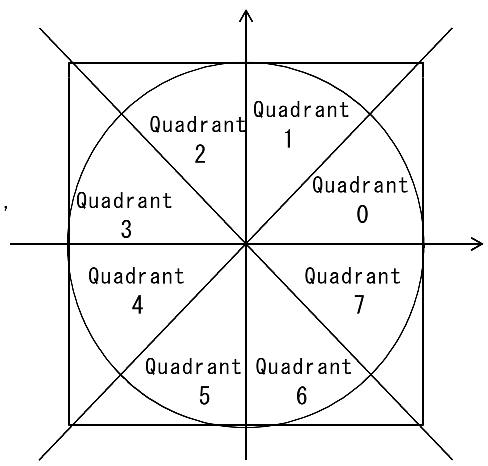
② Set the circular passing-point address for the main axis (X or Z axis).

③ Execute main axis (X or Z axis) drive.

■Locus of circular interpolation drive (example of CCW circulation)



The locus of the circular interpolation drive runs along the circumference having the distance between the current position and circular center point as its radius.
If the destination does not exist on the circumference, the drive pauses at the position where the short axis in the same quadrant as the destination matches.
After the DRIVE DELAY TIME elapses, the system moves to the destination by linear interpolation drive.



- ◆ Short axis of circular interpolation: When the circular center point is (0, 0), the axis for which the absolute value of the interpolation coordinate (X, Y) is smaller is the short axis.
- ◆ The 2-axis linear interpolation drive requires parameters to be set for X axis or Z axis (main axis) linear acceleration/deceleration or S-curve acceleration/deceleration drive.
- ◆ The absolute address 2-axis circular interpolation drive requires the following drive parameters to be set:
  - ・CENTER POSITION : X-Y coordinate address of circular center point (for center-point circular interpolation drive)
  - ・PASS POSITION : X-Y coordinate address of circular passing point (for passing-point circular interpolation drive)

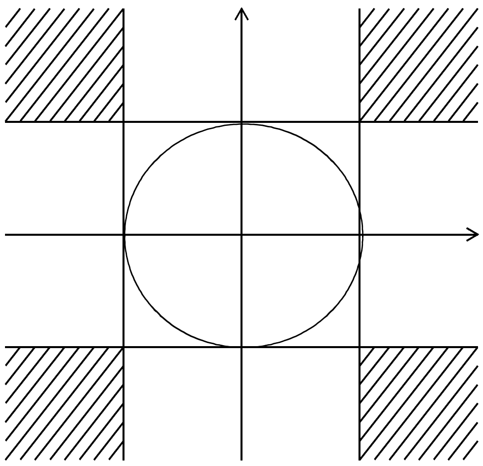
■Notes on circular interpolation drive

In any of the following cases, STATUS1 PORT ERROR of the main axis (X or Z axis) is set to 1 and drive is disabled.

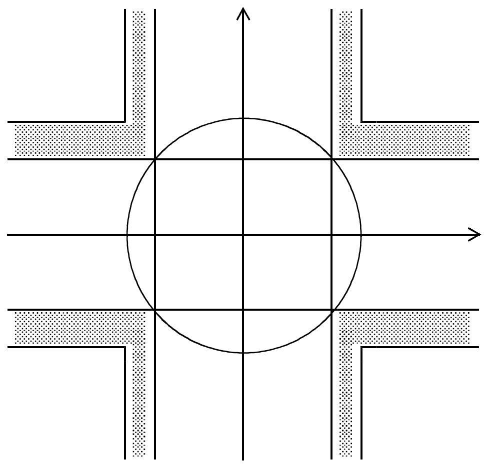
- For center-point circular interpolation, the current position and circular center point are on the same coordinates or the center point and destination are on the same coordinates.
- For passing-point circular interpolation, two of the current position, passing point, and destination are on the same coordinates.
- For passing-point circle interpolation, two of the current position, passing point 1, and passing point 2 are on the same coordinates.
- The distance between the current position and the circular center point is outside the range from 2 to 759,250,124.
- For the circle having the distance between the current position and circular center point as its radius, the destination is specified in the shaded area in the left figure below.

If the destination does not exist on the circumference, the drive pauses at the position where the short axis in the same quadrant as the destination matches. However, if the destination is specified in the ░ area in the right figure below, the drive pauses at the position where the long axis matches.

Error if specified in the shaded area



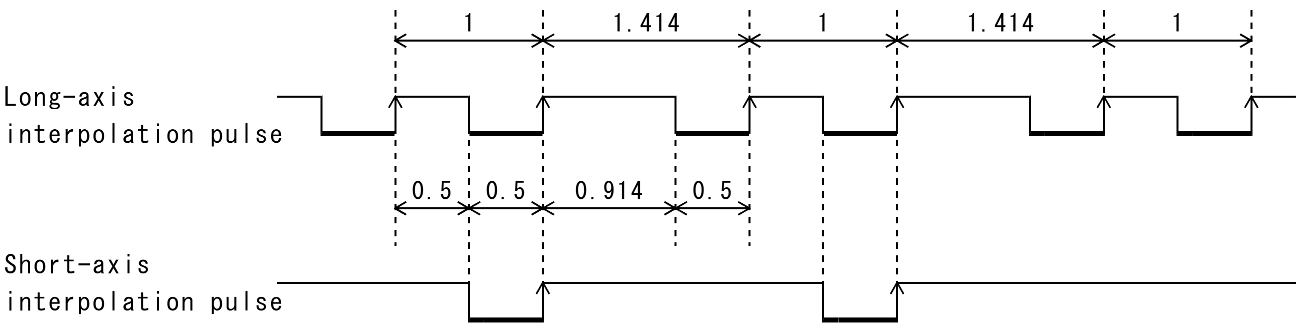
Pause at long-axis matching if specified in ░ area



(3) Linear speed constant control

Control is performed to keep the synthesized speed of the two axes working for interpolation drive constant.
When two axes output pulses simultaneously, the next pulse output cycle is multiplied by 1.414.
Low-level width remains unchanged and high-level width becomes wider.

■Interpolation pulse output at constant linear speed (example of 2-axis liner interpolation drive)



If acceleration/deceleration drive is performed at constant linear speed, the drive at the end speed after deceleration becomes longer.

8-8. Stopping Pulse Output

The pulse output stop function is used to terminate the drive in execution.
The pulse output stop function includes the slow stop function, immediate stop function, LIMIT slow stop function, and LIMIT immediate stop function.

◆ When STATUS1 PORT EXT PULSE = 1 (external pulse being output), the stop command is disabled.

(1) Slow stop function

The slow stop function is enabled when STATUS1 PORT STBY = 1 or DRIVE = 1.
When an active slow stop command is detected, drive pulse output in execution is slowed down to the end speed and is stopped, and then the drive ends.
STATUS1 PORT SSEND is set to 1 upon detection of an active slow stop command.
The slow stop function includes the following slow stop commands:

- SLOW STOP command
- SLSTOP signal that uses general-purpose input or SENSOR signal as the SLSTOP function
- SS0, SS1, and DALM signals that set the input function for slow stop
- Comparator output of various counters that set the stop function for slow stop

◆ When the slow stop command is detected when STBY = 1, the slow stop function works after DRIVE is set to 1.

◆ If the slow stop command is active immediately before STBY is set to 1, the drive ends.

◆ The slow stop function is disabled when STBY = 1 while interpolation drive is stopped after execution.

(2) Immediate stop function

The immediate stop function is enabled when STATUS1 PORT BUSY = 1.
When an active immediate stop command is detected, the drive in execution is forcibly terminated.
STATUS1 PORT FSEND is set to 1 upon detection of an active immediate stop command.
The immediate stop function includes the following immediate stop commands:

- FAST STOP command
- FSSTOP1 signal
- FSSTOP2 signal
- SS0, SS1, and DALM signals that set the input function for immediate stop
- Comparator output of various counters that set the stop function for immediate stop

◆ When the immediate stop command is detected while drive pulse output is active, pulse output ends after the active width of the pulses being output is secured.

◆ The data setting command being executed is not forcibly terminated even if an immediate stop command is detected.
The FSEND flag remains unchanged.

■ Execution sequence of drive stop command

COMMAND PORT WRITE	① Write a command to the drive command port. ・SLOW STOP command ・FAST STOP command

(3) LIMIT slow stop function

The LIMIT slow stop function is enabled when STATUS1 PORT STBY = 1 or DRIVE = 1.

The LIMIT slow stop function includes the following LIMIT slow stop commands:

・CWLM and CCWLM signals that set the input function for LIMIT slow stop
・Stop at the SOFT LIMIT position by the SOFT LIMIT function

◆ When the slow stop command is detected when STBY = 1, the LIMIT slow stop function works after DRIVE is set to 1.
◆ If the LIMIT slow stop command is active immediately before STBY is set to 1, the drive ends.
◆ If the slow stop command for the CWLM or CCWLM signal is active immediately before STBY is set to 1 during interpolation drive, the drive ends regardless of the drive direction.
◆ The LIMIT slow stop function is disabled when STBY = 1 while interpolation drive is stopped after execution.

● CWLM signal : When the active level is detected during drive in the + direction, the drive pulse output in the + direction is slowed down and stopped to end the drive. This signal is invalid during drive in the - direction.

● CCWLM signal : When the active level is detected during drive in the - direction, the drive pulse output in the - direction is slowed down and stopped to end the drive. This signal is invalid during drive in the + direction.
Upon detection of an active CCWLM signal, STATUS1 PORT SSEND and LSEND are set to 1.

(4) LIMIT immediate stop function

The LIMIT immediate stop function is enabled when STATUS1 PORT STBY = 1 or DRIVE = 1.

The LIMIT immediate stop function includes the following LIMIT immediate stop commands:

・CWLM and CCWLM signals that set the input function for LIMIT immediate stop

◆ When the LIMIT immediate stop command is detected while drive pulse output is active, pulse output ends after the active width of the pulses being output is secured.
◆ For 2-axis interpolation drive, the function is enabled even when STBY = 1 after drive execution is stopped.
The function is enabled while the DEND signal at STBY = 1 is in <servo support> or while the END PULSE drive at STBY = 1 is in DELAY.

● CWLM signal : When the active level is detected during drive in the + direction, the drive pulse output in the + direction is immediately stopped to end the drive. This signal is invalid during drive in the - direction.
Upon detection of an active CWLM signal, STATUS1 PORT FSEND and LSEND are set to 1.

● CCWLM signal : When the active level is detected during drive in the - direction, the drive pulse output in the - direction is immediately stopped to end the drive. This signal is invalid during drive in the + direction.
Upon detection of an active CCWLM signal, STATUS1 PORT FSEND and LSEND are set to 1.

8-9. MANUAL SCAN Drive

(1) Selecting axes

Operate the SEL D, SEL C, SEL B, and SEL A signals of the J2 connector to select an axis that performs MANUAL SCAN drive.

Specified axis	SEL_ D	SEL_ C	SEL_ B	SEL_ A
X axis	ON	ON	ON	ON
Y axis	ON	ON	ON	OFF
Z axis	ON	ON	OFF	ON
A axis	ON	ON	OFF	OFF
Setting is disabled.	ON	OFF	ON	ON
…	…	…	…	…
Setting is disabled.	OFF	OFF	OFF	OFF

(2) Executing MANUAL SCAN drive

Operate the $\overline{\text{MAN}}$, $\overline{\text{CWMS}}$, and $\overline{\text{CCWMS}}$ signal inputs to the J2 connector to perform MANUAL SCAN drive in the + or − direction. The drive parameters for the MANUAL SCAN drive are the initial values after the reset defined in JP1 or the current parameter values.

◆ Speed changes when the $\overline{\text{MAN}}$ signal is set in the high level (OFF) can be performed by setting parameters in general-purpose command RATE SET or HSPD SET.
The command is executed after confirming BUSY = 0 and MAN = 0 in MCC06 STATUS1 PORT.

◆ Speed changes when the $\overline{\text{MAN}}$ signal is set in the low level (ON) can be performed using the speed drive change function of a special command.
The speed drive change function executes the command after confirming MAN = 1 in MCC06 STATUS1 PORT and SPEED CBUSY = 0.

* For the speed drive change function, refer to the separate manual "Technical Data A."

● $\overline{\text{MAN}}$ signal: Set in the low level (ON) to perform MANUAL SCAN drive.
- When the $\overline{\text{MAN}}$ signal is set to ON while STATUS1 PORT BUSY = 0, STATUS1 PORT MAN is set to 1, enabling the $\overline{\text{CWMS}}$ or $\overline{\text{CCWMS}}$ signal to be used to operate the MANUAL SCAN drive.
- The MANUAL SCAN drive is forcibly ended if the $\overline{\text{MAN}}$ signal is set in the high level (OFF) during the execution of the MANUAL SCAN drive.
- The MANUAL SCAN drive is restarted if the $\overline{\text{MAN}}$ signal (OFF) is set to ON while the $\overline{\text{CWMS}}$ or $\overline{\text{CCWMS}}$ signal is in the low level (ON).

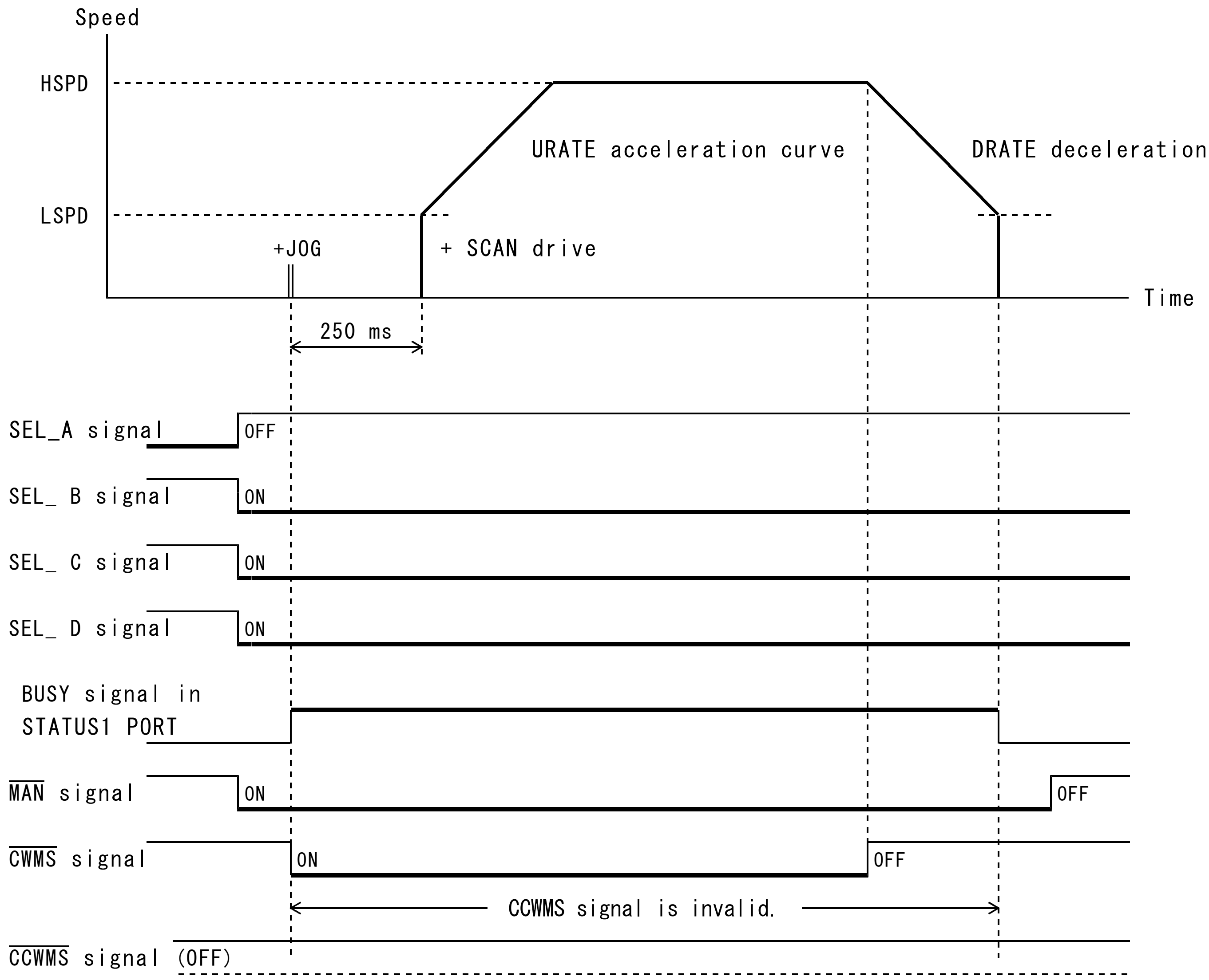
● $\overline{\text{CWMS}}$ signal: Used to operate the MANUAL SCAN drive in the + direction. (+ direction operation signal)
- The MANUAL SCAN drive is started when the $\overline{\text{CWMS}}$ signal is set in the low level (ON) while STATUS PORT MAN is 0 and the $\overline{\text{CCWMS}}$ signal is in the high level (OFF).
  When the $\overline{\text{CWMS}}$ signal is set in the high level (OFF) during the SCAN drive, the SCAN drive is slowed down and stopped.
- To restart the MANUAL SCAN drive after it is stopped, set the $\overline{\text{CWMS}}$ signal (OFF) to ON.
- CWMS signal operation is disabled during drive in the − direction.

● $\overline{\text{CCWMS}}$ signal: Used to operate the MANUAL SCAN drive in the − direction. (− direction operation signal)
- The MANUAL SCAN drive is started when the $\overline{\text{CCWMS}}$ signal is set in the low level (ON) while STATUS PORT MAN is 0 and the $\overline{\text{CWMS}}$ signal is in the high level (OFF).
  When the $\overline{\text{CCWMS}}$ signal is set in the high level (OFF) during the SCAN drive, the SCAN drive is slowed down and stopped.
- To restart the MANUAL SCAN drive after it is stopped, set the $\overline{\text{CCWMS}}$ signal (OFF) to ON.
- $\overline{\text{CCWMS}}$ signal operation is disabled during the execution of the drive in the + direction.

■ Signal operation for MANUAL SCAN drive

＜Example of Y axis in the + direction＞

After executing JOG drive in the + direction, execute linear acceleration/deceleration SCAN drive in the + direction.



① The $\overline{\text{MAN}}$ signal is set in the low level when the BUSY signal is in the low level.

② The $\overline{\text{CWMS}}$ signal is set to ON.
- The BUSY signal is set in the high level and the MANUAL SCAN drive in the + direction starts.

③ The $\overline{\text{CWMS}}$ signal is set to OFF.
- Pulse output in execution is slowed down and then stopped to end the drive.
- After the end of the drive, the BUSY signal is set in the low level.

④ After the BUSY signal is set in the low level, the $\overline{\text{MAN}}$ signal is set in the high level.

8-10. Setting Interrupts

Interrupt signals that can be output to the INTA# signal on the PCI bus are INT2 to INT0.
Each interrupt signal is output to INTA# when an interrupt is caused.
In addition, the command reservation function (applied function) uses the INT3 signal to interlock command execution when a cause of clearing the reservation command register is generated.
These interrupt signals can individually be masked or clear the interrupt output.
* For the execution sequence for making settings for cleaning the reservation command, refer to the separate manual "Technical Data A."

■INT3 to INT0 signals

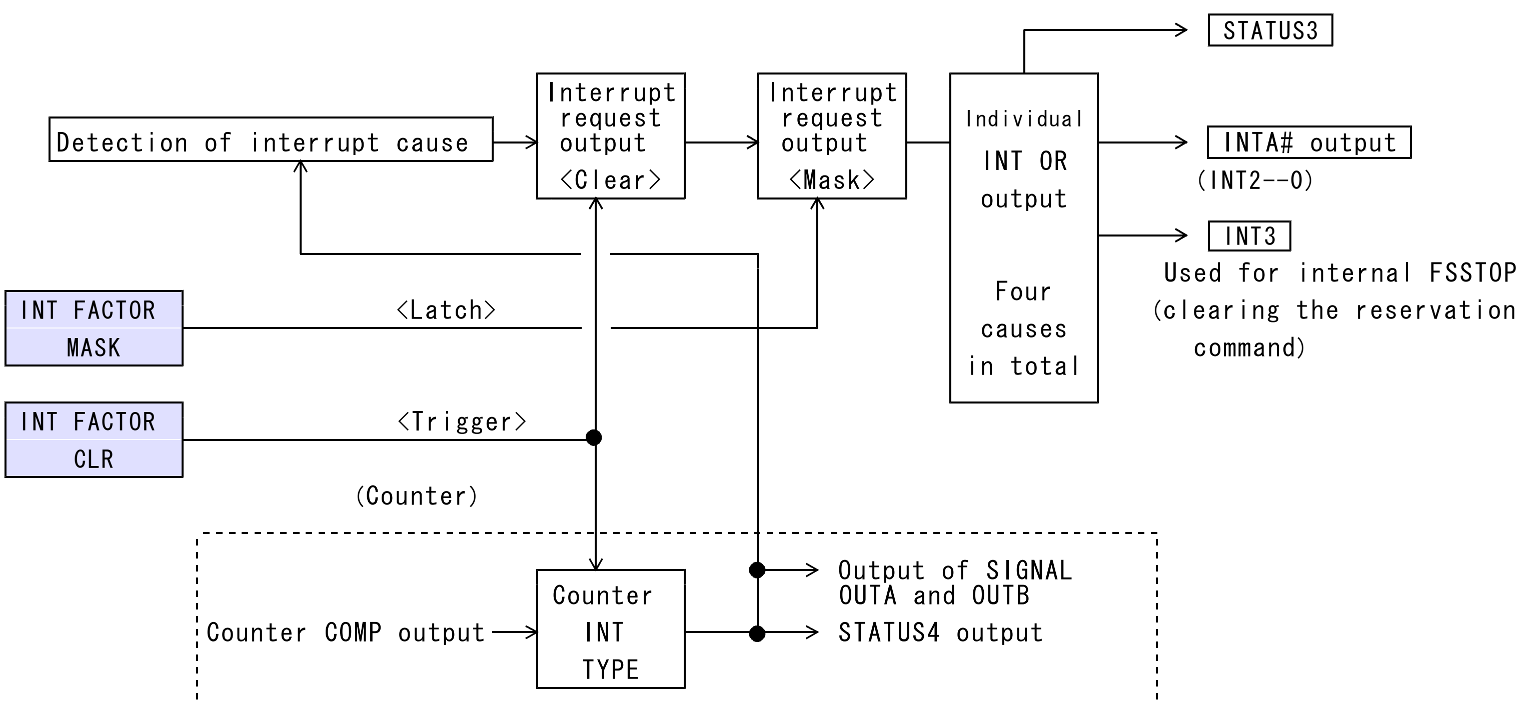
- Twelve interrupt requests are output to the INT2 to INT0 signals by logically adding (OR) all signals in each INT to output them.
  Interrupt requests are output to INTA# upon detection of an active edge of an interrupt cause.
- For INT3, an ERROR flag is assigned to GPIO0 and FSEND flag to GPIO1 by the HARD INITIALIZE2 command. When a cause of clearing the reservation command is generated, the INT3 signal clears the reservation command.
- Fourteen interrupt request outputs are individually cleared by the INT FACTOR CLR command. They can also be individually masked by the INT FACTOR MASK command.

* For the command reservation function, refer to the separate manual "Technical Data A."

Interrupt request output		Interrupt cause <edge detection>	Clearance method
INT0	RDYINT	・Command end interrupt request RDYINT = 1	・Clear by INT FACTOR CLR command
	STBY	・STATUS1 PORT STBY = 1	
	COMREG EP	・STATUS5 PORT COMREG EP = 1	
	nCOMREG FL	・STATUS5 PORT COMREG FL = 0	
INT1	MAN	・STATUS1 PORT MAN = 1	・Clear by INT FACTOR CLR command
	DALM	・STATUS2 PORT DALM = 1	
	SS0	・STATUS5 PORT SS0 = 1	
	SS1	・STATUS5 PORT SS1 = 1	
INT2	ADRINT	・Counter interrupt request ADRINT = 1	・Clear by INT FACTOR CLR command
	CNTINT	・Counter interrupt request CNTINT = 1	
	DFLINT	・Counter interrupt request DFLINT = 1	
	SPDINT	・Counter interrupt request SPDINT = 1	
INT3	GPIO0(ERROR)	・STATUS3 PORT GPIO0 (ERROR) = 1	・Clear by INT FACTOR CLR command
	GPIO1(FSEND)	・STATUS3 PORT GPIO1 (FSEND) = 1	
	—	Reserved	
	—	Reserved	

The output status of INT3-0 can be checked at STATUS3 PORT. Interrupt request outputs can be cleared even when the interrupt cause is in the active level. After clearing, an interrupt request is output if the active level changes from ON to OFF and then to ON.

■ Interrupt causes and INTA# output configuration



8-11. Using the External Signal Function

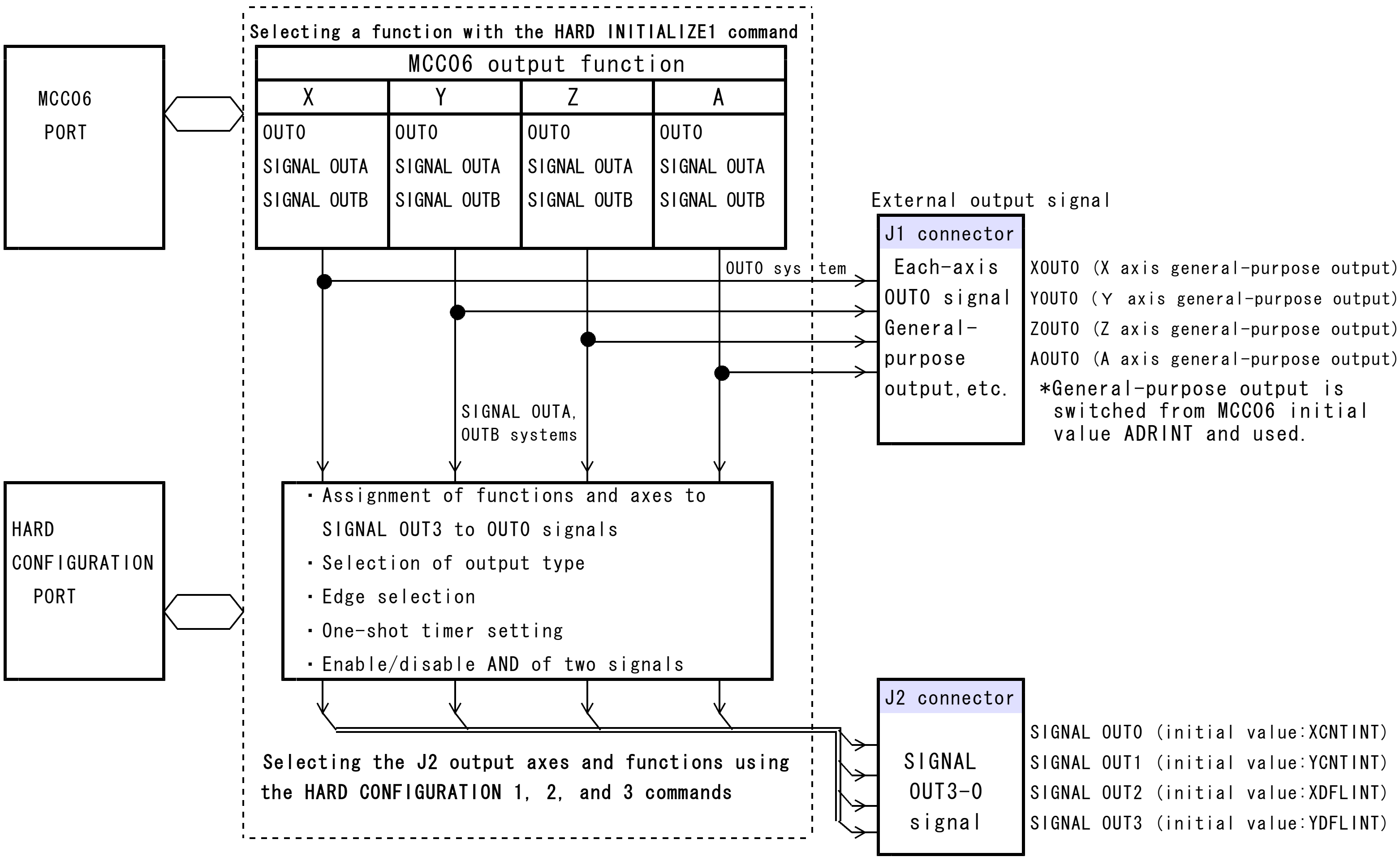
(1) External output signal function

The MCC06 general-purpose output (OUT0 signal) function can be used to control the output of general-purpose signals.
The SIGNAL OUT command is used to output general-purpose signals. This command can always be used.
The hardware setting function by the HARD CONFIGURATION command allows the user to freely customize the assignment of external output signals from J2.

●Selecting signals to be output to SIGNAL OUT3-0 of the J2 connector
SIGNAL OUTA and SIGNAL OUTB signals from MCC06 can be assigned to SIGNAL OUT3-0 output signals.

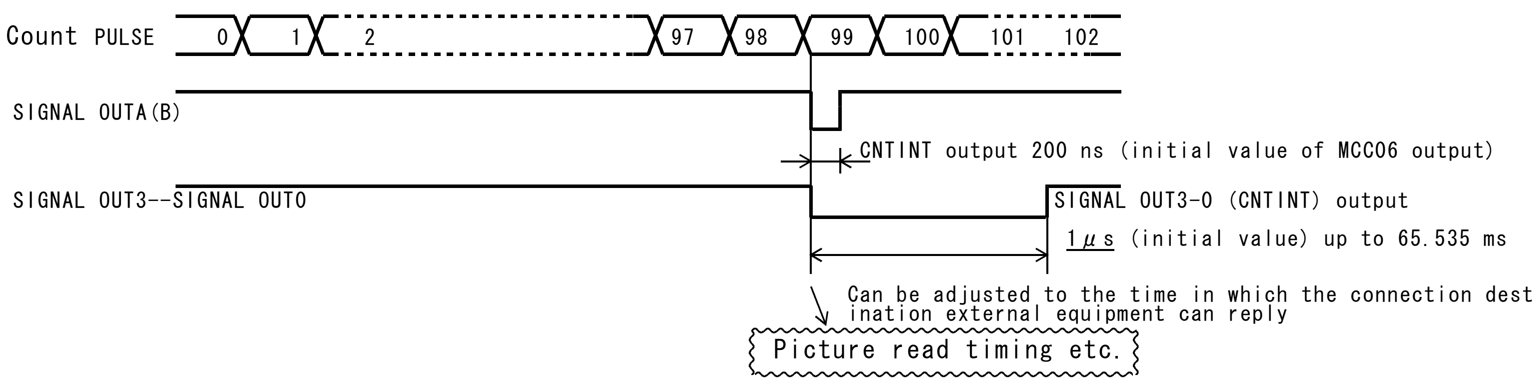
- The HARD INITIALIZE1 command can be used to select MCC06 SIGNAL OUTA, B functions (ADRINT, CNTINT, DFLINT, SPDINT, STBY, DRIVE, ERROR etc.)
- For signal outputs, selected signals can be either output without being latched, or one-shot output with a width from 1 μs to 65.535 ms (arbitrary setting of each μs.) after selecting the e dge direction.
  This function enables real-time control of synchronization with external equipment such as using counter values as camera trigger signals.
- The SIGNAL OUTA and OUTB signals of any two axes can be output by using the AND condition.

■ External output signal function blocks



■ Synchronizing with external equipment using the counter matching signal
SIGNAL OUTA and SIGNAL OUTB can be output to SIGNAL OUT3-0 assigned by the HARD CONFIGURATION1 command.
When these signals are set to ON, the open collector output circuit goes ON.

【Example of matching with pulse counter output value 100】

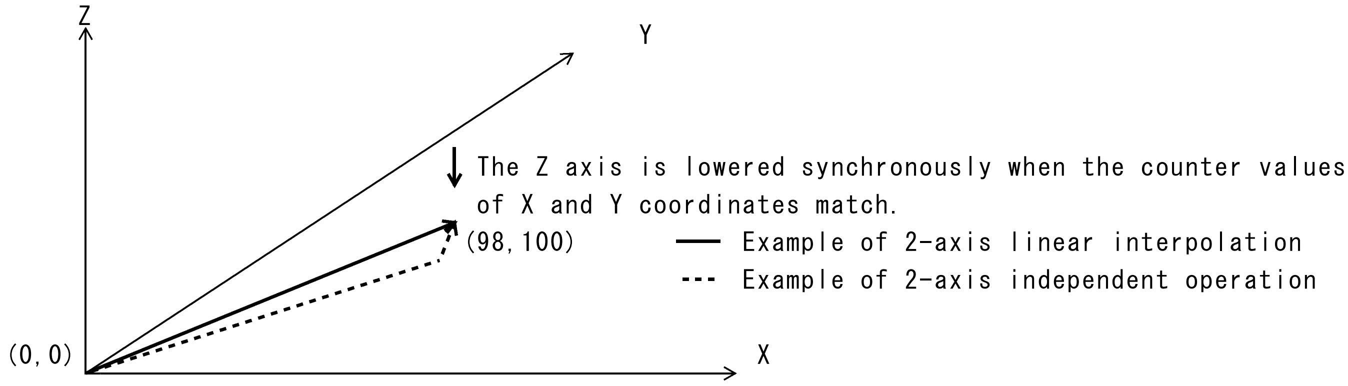


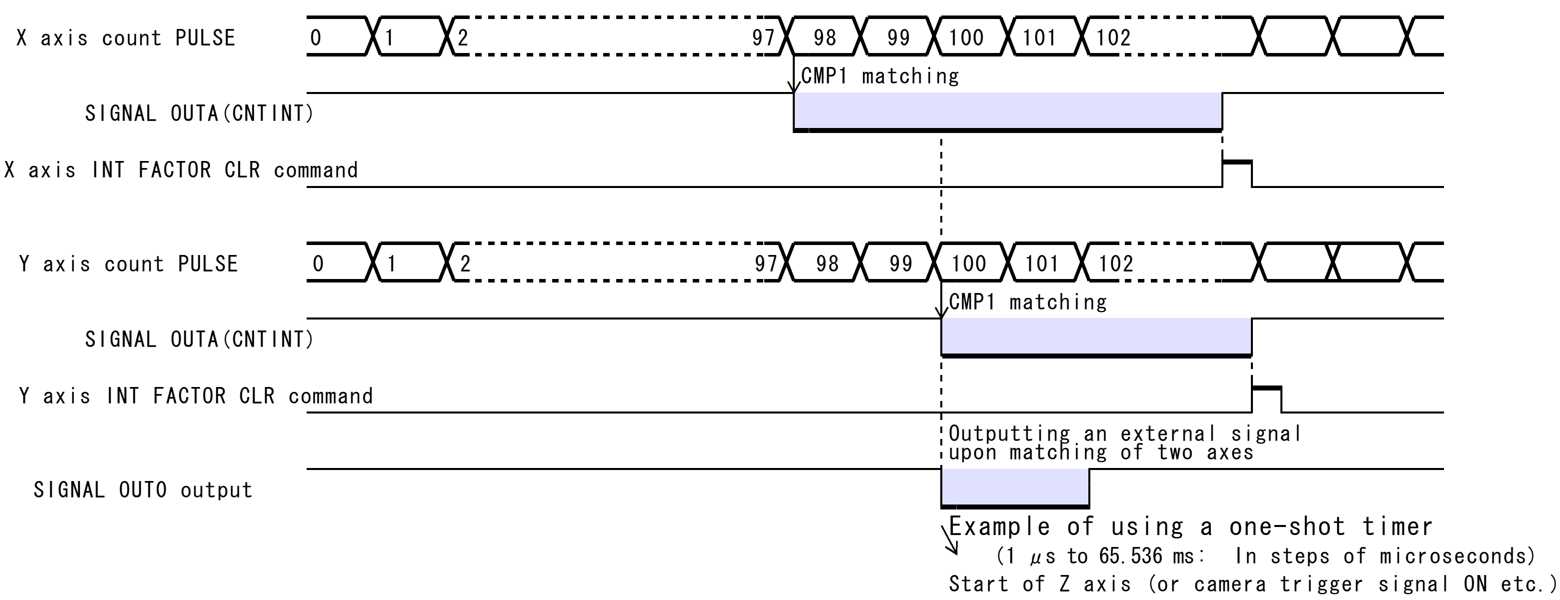
■ Combinations of external output signals

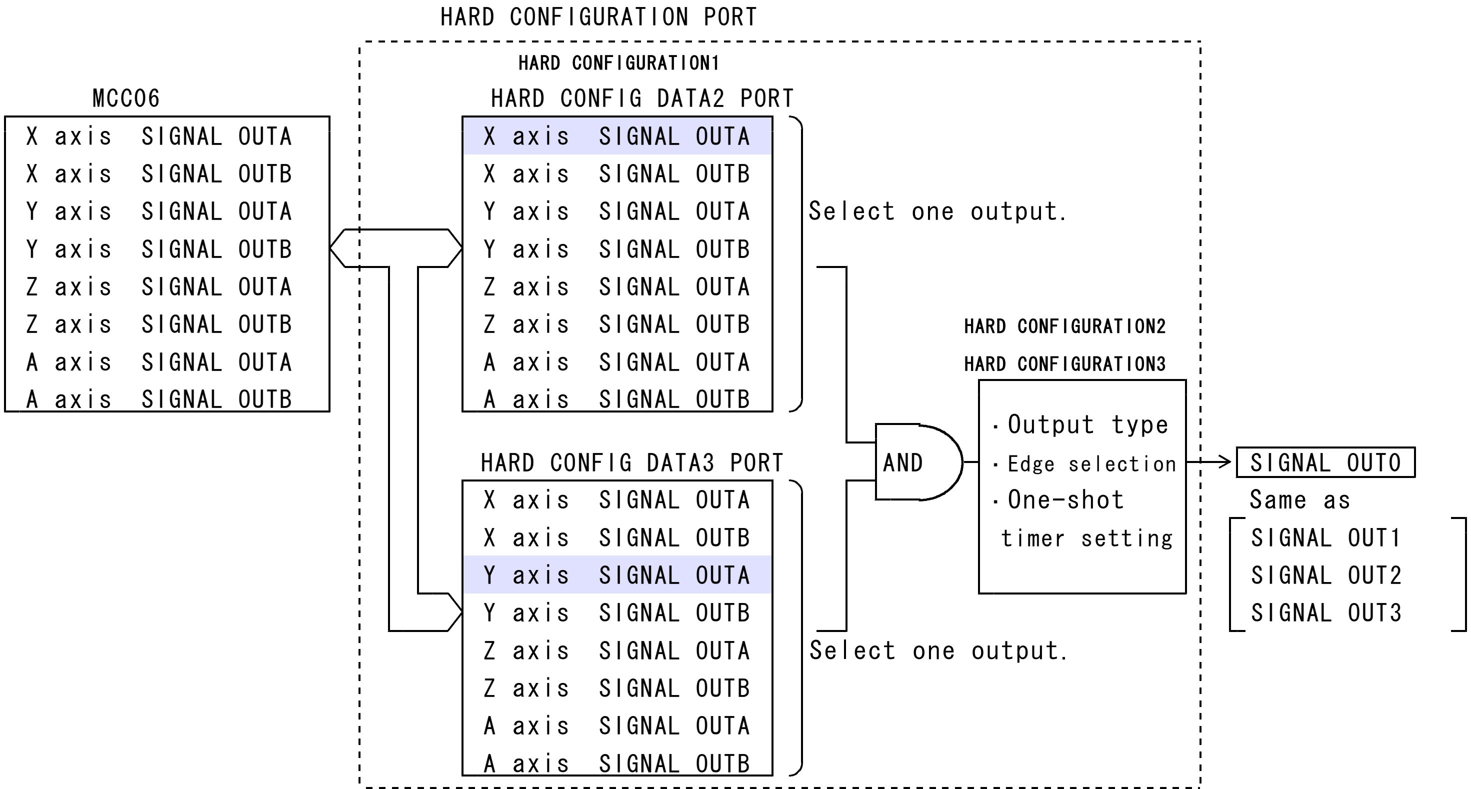
The hardware setting function by the HARD CONFIGURATION command can be applied to start an arbitrary axis (such as the Z axis) or output a camera trigger signal synchronously when the coordinates of two arbitrary axes (such as X and Y axes) match.

Example)

C-V870 external output signal SIGNAL OUT0 is set to ON in one shot when the requirements for the X axis SIGNAL OUTA signal (initial value CNTINT) and Y axis SIGNAL OUTA (initial value CNTINT) are satisfied.
For this operation, select the edge latch or level latch that holds the INT TYPE by the INITIALIZE1 command of each counter until the STATUS4 PORT is read or the edge latch that holds it until the INT FACTOR CLR command is executed.

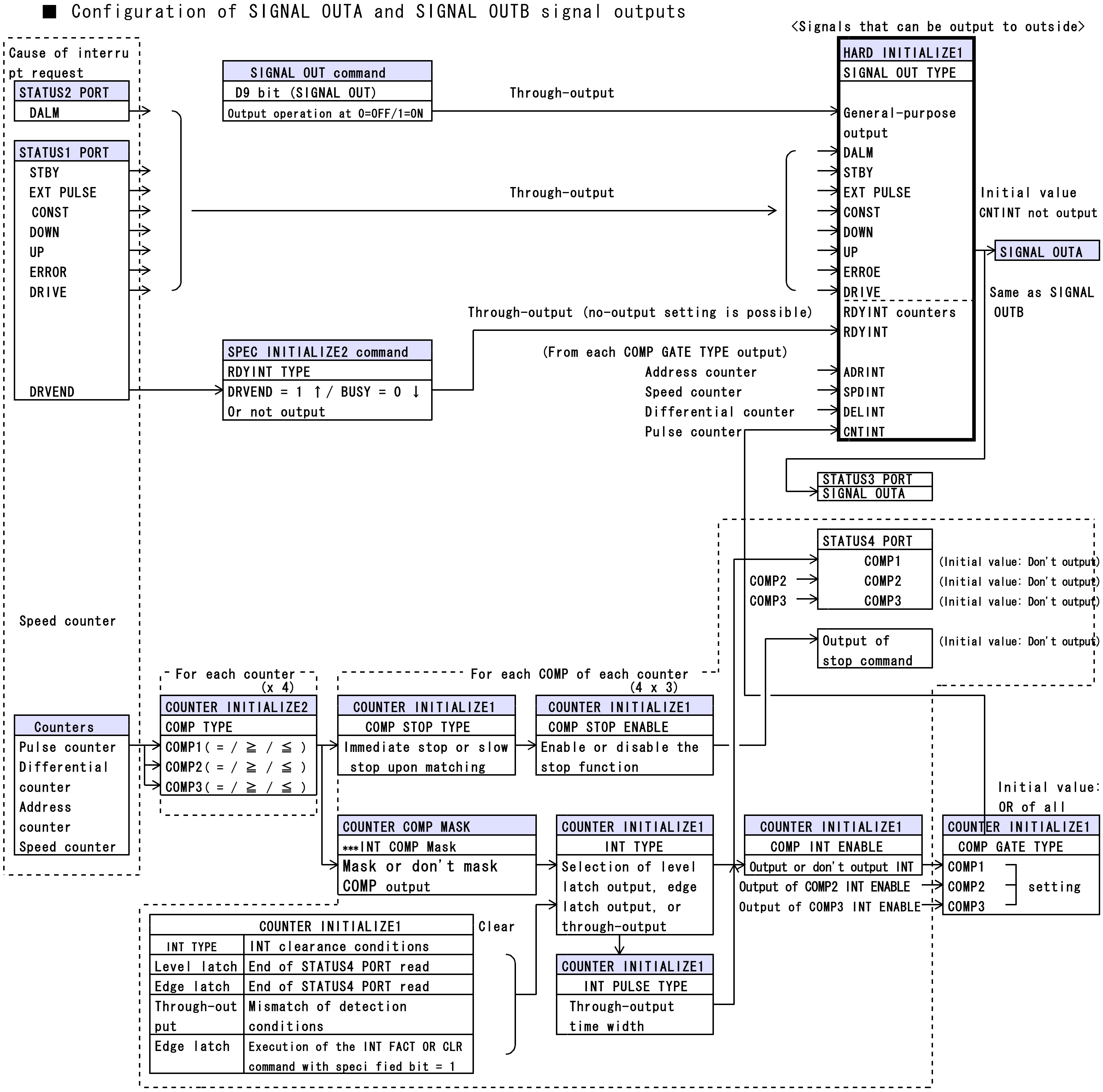






◆ The HARD CONFIGURATION1 command is used to set the AND condition between HARD CONFIG DATA2 PORT and HARD CONFIG DATA3 PORT.
In the above example, output is made to SIGNAL OUT0 when the CNTINT conditions of the X and Y axes are satisfied. To enable output based on the condition of a single axis, set the same data for both DATA2 PORT and DATA3 PORT.

■ Configuration of SIGNAL OUTA and SIGNAL OUTB signal outputs

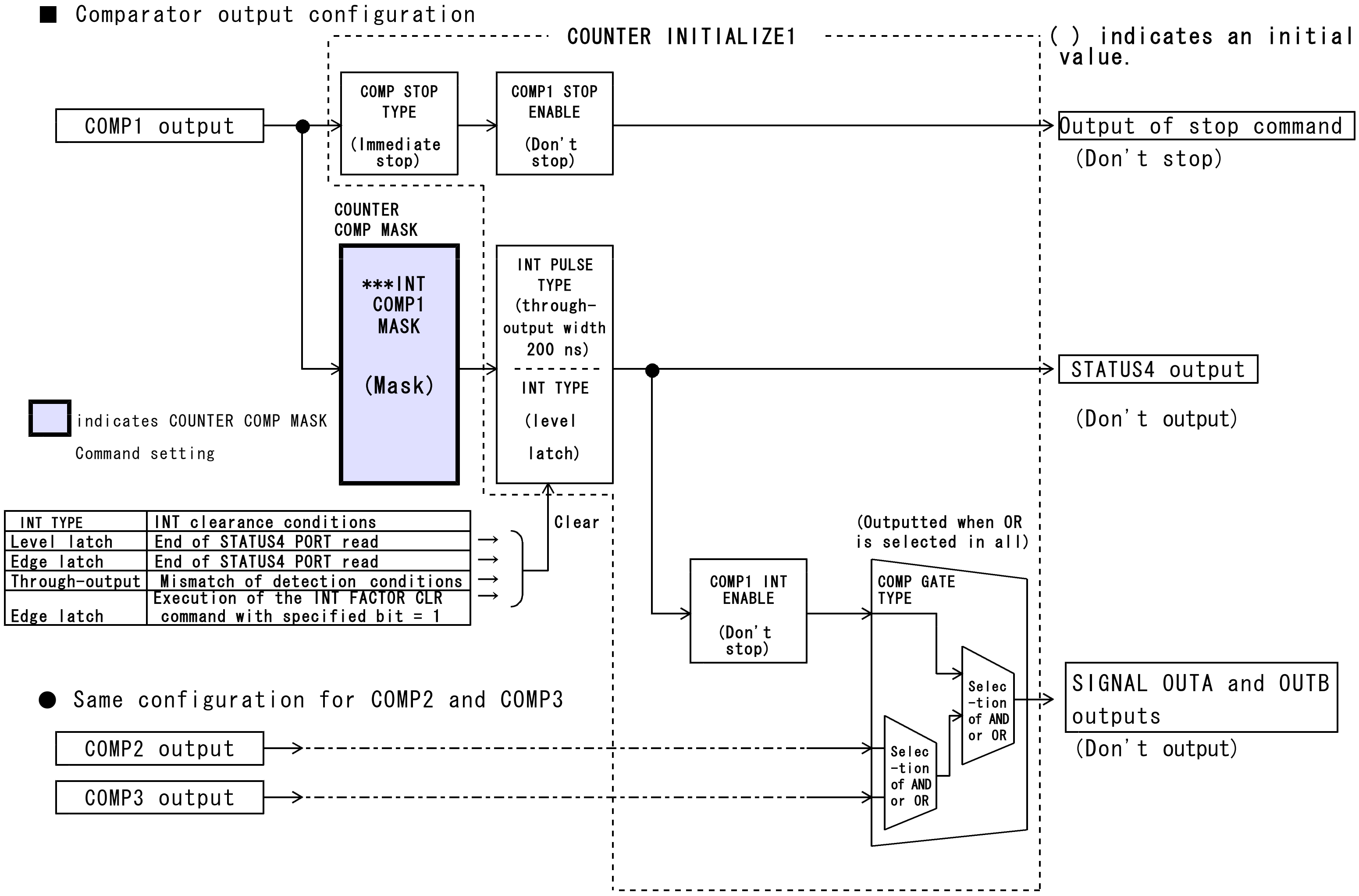


- Use the HARD CONFIGURATION1 command to assign the SIGNAL OUTA and OUTB outputs to SIGNAL OUT3 to OUT0.
- Use the HARD CONFIGURATION2 command to select whether to perform through-output or one-shot output of SIGNAL OUTA and OUTB to the SIGNAL OUT3 to OUT0 outputs.
- If one-shot output is selected for the SIGNAL OUT3 to OUT0 outputs, use the HARD CONFIGURATION3 command to set the one-shot timer.

■ Causes of counter interrupt signal output and clearance command

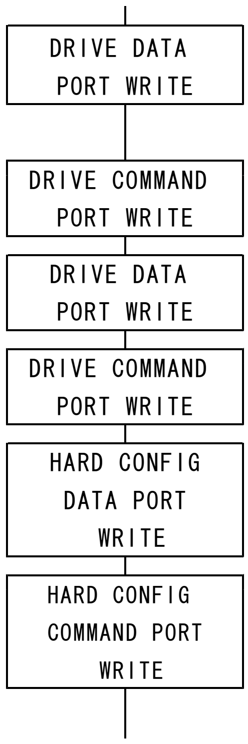
Interrupt request output		Interrupt cause	Clearance method
SIGNAL OUTA SIGNAL OUTB output selection	RDYINT	<Interrupt cause selection: Edge detection> ・STATUS1 PORT DRVEND = 1 ・STATUS1 PORT BUSY = 0	・Clear by ending STATUS1 PORT read ・Clear by executing general-purpose command ・Clear by executing other BUSY=1
	ADRINT	・Composite output of COMP1, COMP2, and COMP3 of address counter	・The COMP1, COMP2, and COMP3 outputs are all set to 0.
	CNTINT	・Composite output of COMP1,COMP2, and COMP3 of pulse counter	・The COMP1, COMP2, and COMP3 outputs are all set to 0.
	DFLINT	・Composite output of COMP1, COMP2, and COMP3 of pulse differential counter	・The COMP1, COMP2, and COMP3 outputs are all set to 0.
	SPDINT	・Composite output of COMP1, COMP2, and COMP3 of pulse cycle counter	・The COMP1, COMP2, and COMP3 outputs are all set to 0.

■ Comparator output configuration



INT TYPE	INT clearance conditions
Level latch	End of STATUS4 PORT read
Edge latch	End of STATUS4 PORT read
Through-output	Mismatch of detection conditions
Edge latch	Execution of the INT FACTOR CLR command with specified bit = 1

■ Selection of SIGNAL OUTA and OUTB signals and SIGNAL OUT3-0 assignment sequence



① Using each COUNTER INITIALIZE1 command, write the external output conditions conditions to the DRIVE DATA PORT. (Refer to "Comparator output configuration" above.)

② Write each COUNTER INITIALIZE1 command to the DRIVE COMMAND PORT.

③ Using the HARD INITIALIZE1 command, write the data about the selection of counter interrupts to be output to SIGNAL OUTA and OUTB to the DRIVE DATA PORT.

④ Write the HARD INITIALIZE1 command to the DRIVE COMMAND PORT.

⑤ Write the data about the selection of the signals to be output to SIGNAL OT3-0 and the relevant axes to the HARD CONFIG DATA PORT.

⑥ Write the HARD CONFIGURATION1 command to the HARD CONFIG COMMAND PORT.
In the same way as the HARD CONFIGURATION1 command in ⑤ and ⑥, execute the HARD CONFIGURATION2 command to select through-output or one-shot output and execute the HARD CONFIGURATION3 command to set the one-shot timer.

◆ To perform one-shot output using the HARD CONFIGURATION command, set the following conditions with each COUNTER INITIALIZE1 command of MCC06:
- Each INT TYPE : Through-output of matching output
- Each INT PULSE TYPE : 200ns

(2) External input signal function

■ External input signal assignment function

The hardware setting function of the HARD CONFIGURATION command enables the user to freely customize the assignment of external input signals.

● Selecting the function that inputs the SENSOR0 and SENSOR1 signals from the J1 connector to the MCC06 signal, and the relevant axis

● Selecting the function that inputs the SIGNAL IN3 to SIGNAL IN0 signals from the J2 connector to the MCC06 signal, and the relevant axis

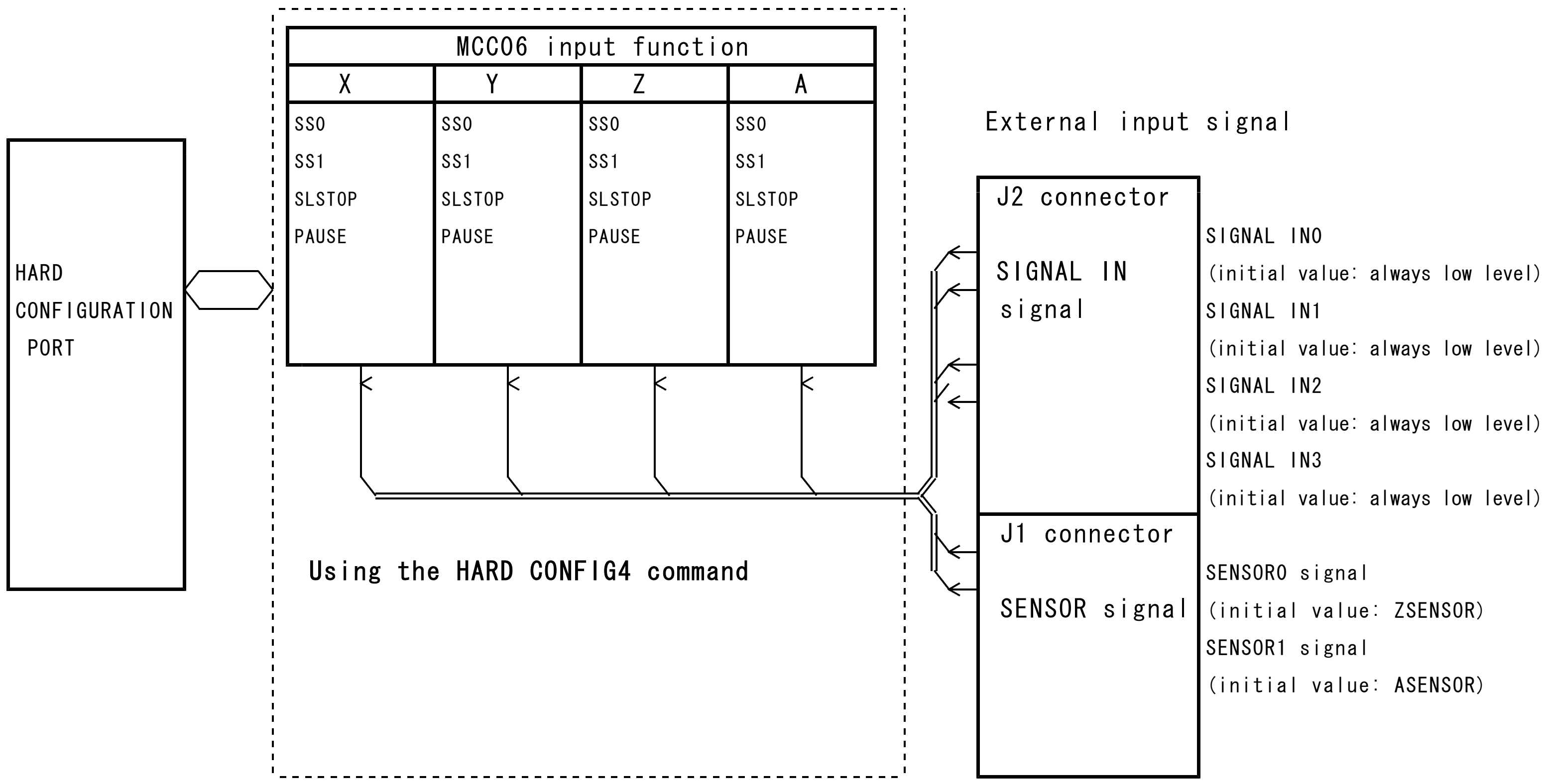
The following functions can be assigned to these input signals:

- Enabling the SENSOR drive using the SS0 or SS1 signal for the selected axis
- Switching between UP, DOWN, and CONST drives using the SS0 or SS1 signal
- Controlling the time measurement trigger signal of the pulse cycle counter using the SS0 or SS1 signal
- Inputting a slow stop signal or immediate stop signal to the selected axis
- Inputting a PAUSE signal to the selected axis

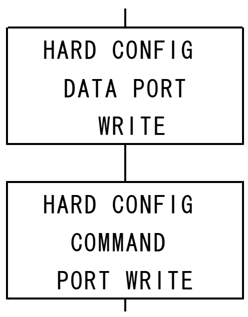
  The axis to which a PAUSE signal is input can start in synchronization with the PAUSE signal release timing.

■ External input signal function blocks

Set the MCC06 input signals and axes to which external input signals (SIGNAL IN0 to SIGNAL IN3, SENSOR0, and SENSOR 1) are assigned.



■ SIGNAL IN3-0 assignment sequence



① Write the data about the selection of the signals to be input to SIGNAL IN3-0 and the relevant axes to the HARD CONFIG DATA PORT.

② Write the HARD CONFIGURATION4 command to the HARD CONFIG COMMAND PORT.

8-12. Selecting Motor Type

(1) Selecting motor type

Use the HENSA INITIALIZE1 command to set I/O signals for a stepping or servo motor.
For the servo motor, successively use the MCC06 SERVO SPEC command to set functions.
To detect that the stepping motor steps out, use the MCC06 SERVO SPEC SET command to immediacy disable the DALM function and enable the DRST function and set necessary parameters at the HENSA COMMAND PORT.

■ Execution sequence for motor type selection

HENSA COMMAND PORT WRITE	①Write the HENSA INITIALIZE1 command to the HENSA COMMAND PORT.
DRIVE DATA PORT WRITE	② Use the SERVO SPEC command to set necessary parameters in the DRIVE DATA PORT.

(dashed box) Set this step when initial and set values need to be changed.

Set this step when initial and set values need to be changed.

SEL2	SEL1	SEL0	Control method	Position detection	Z phase	DALM	P0 / DEND	OUT1/DRST	OUT0
0	0	0	Stepping motor: Open loop	Not required	Invalid	Reporting only	P0 detection possible	General-purpose output (such as MF)	General-purpose output (such as CS)
0	0	1	Servo motor: Feedback loop	Encoder input possible	Valid	Reporting only	DEND	DRST output	General-purpose output (such as SON)
0	1	1	Stepping motor: Step-out error detection	Encoder	Valid	Invalid (*1) (To GPIO7)	Invalid	Invalid	General-purpose output (such as CS)

● A post-reset initial value is 00H (stepping motor: open loop).

In the DALM setting, the "Reporting only (general-purpose input)" specification can be switched to "immediate stop" or "slow stop" with the MCC06 SERVO SPEC SET command.

◆ SEL settings (a combination) other than listed above are inhibited.

◆ *1 internally uses the DALM function.
As a general-purpose input at this point, reading from the STATUS3 PORT (GPIO7) is possible.

(shaded box) is an applied function. Refer to the separate manual "Technical Data A."

(2) Functions for servo

The signals for a servo driver include the DRST signal output (servo reset output), DEND signal input (servo positioning completion input), and DALM signal input (servo alarm input).

■ Response to servo by DRST signal

If the active level of an immediate stop command is detected during drive, the DRST signal goes ON for 10 ms.
The DRST command also enables the DRST signal to go ON for 10 ms.
The DRST signal can also be used as a general-purpose output.

● Immediate stop command

FAST STOP command, FSSTOP1 signal, FSSTOP2 signal, CWLM and CCWLM signals set to LIMIT immediate stop, DALM signal set to immediate stop, and comparator output of various counters set to immediate stop.

◆ The DRST signal is output for the following stops.
- When pulse output is stopped by detecting a LIMIT immediate stop signal during ORIGIN drive execution
- Stop by the ERROR pulse detection function of the ORIGIN drive

◆ When a DRST signal is output with the SERVO SPEC SET command, a DEND signal is not checked even if it is enabled.

◆ When STATUS1 PORT EXT PULSE = 1, the DEND and DRST functions are invalid.

■ Response to servo by DEND signal

Even if pulse output is stopped during drive execution, the drive is not stopped until the active level of the DEND signal is detected.
In this interval, STATUS2 PORT DEND BUSY = 1 is assumed.
The DEND signal can also be used as a general-purpose output.

- ◆ When an immediate stop command is detected, stopping the DEND function forcibly ends the drive. Note that the DEND function is valid at the time of the LIMIT immediate stop during ORIGIN drive execution.
- ◆ When STATUS1 PORT EXT PULSE = 1, the DEND and DRST functions are disabled.

■ DEND ERROR function

If the error judgment time for a DEND signal is reached while the active level of that signal is not detected after pulse output completion or error occurrence, the drive in execution is forcibly ended.
When this function is enabled, STATUS1 PORT ERROR = 1 is assumed.

- ◆ The error judgment time for the DEND signal is set in the DEND TIME SET command.

■ DALM function

This function enables immediate stop and slow stop with an alarm signal from the driver.
This function can also be used as a general-purpose input.
The detected active level of a DALM signal can be read with the STATUS1 PORT.

8-13. Using Synchronous Start Function (STBY, PAUSE)

When the PAUSE signal is set to ON, the drive pulse output starting is suspended (PAUSE=1, STBY=1).
When the PAUSE signal is set to OFF, the pulse output is started by releasing the drive pulse output starting from the suspended state (PAUSE=0, STBY=0).

◆ To select an input signal for operating the PAUSE signal, use the HARD CONFIGURATION4 command.
Note: Leave the MCC06 STBY SPEC SET command in its initial value.
Use the command in the initial value of an MCC06 STBY canceling condition, "STBY TYPE="000": STBY=0 at PAUSE=0."

■STBY flag

This is the STATUS1 PORT STBY flag.
When drive pulse output has been prepared (data processing), STBY=1 is assumed.
If a STBY canceling condition is detected when STATUS1 PORT PAUSE=0, STBY=0 is assumed and the drive pulse output is started.

◆ At the time of stop after interpolation drive execution, the main axis STBY flag is temporarily set to STBY=1.
This STBY=1 is set to STBY=0 when the interpolation drive stops or the next pulse output starts.

■ PAUSE signal

When the PAUSE signal is set to ON, STATUS1 PORT PAUSE=1 is assumed.
When the PAUSE signal is set to OFF, STATUS1 PORT PAUSE=0 is assumed.
When PAUSE=1, the drive pulse output starting is suspended by retaining STBY=1.

The PAUSE signal can be operated as follows.

- Synchronous start to release the PAUSE signal of another axis (or two or more axes) with the counter matching signal of a certain axis
- Synchronous start to release the PAUSE signal with a command at the HARD CONFIGURATION PORT
- Synchronous start to release the PAUSE signal with the SENSOR0 or SENSOR1 signal from the J1 connector
- Synchronous start to release the PAUSE signal with the SIGNAL IN signals (IN0, IN1, IN2, and IN3 optional signals) from the J2 connector

◆ The PAUSE signal and synchronous start function are enabled when the drive is started during execution of a command that involves pulse output.

◆ At the time of temporary stop during the following sequential drive, the PAUSE signal and synchronous start function are disabled.
The STATUS1 PORT PAUSE flag is masked with 0.

- Temporary stop before shift to each process of ORIGIN drive
- Temporary stop before execution of END PULSE drive
- Temporary stop before execution of end-point corrective drive, circular interpolation drive
- Temporary stop before execution of reverse drive with INDEX CHANGE command
- Temporary stop after execution of JOG drive, MANUAL SCAN drive

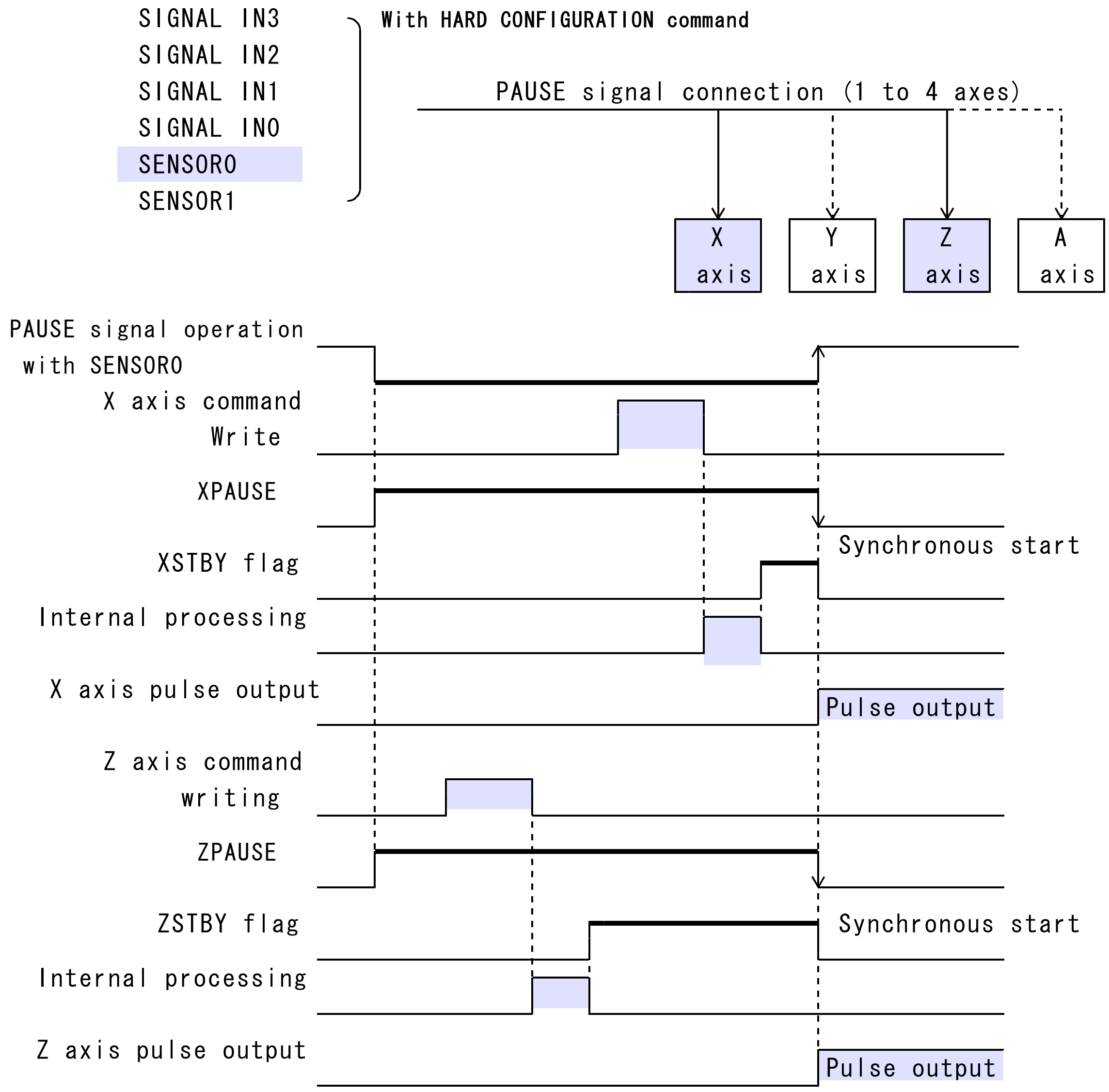
◆ In the interpolation drive, only the PAUSE signal of a main axis and the synchronous start function are valid.
The PAUSE signal of a sub-axis and the synchronous start function are disabled.
The sub-axis is set to STBY=0 when the CPPOUT low-level output is started.

(1) Synchronous start with external input signal

If external output signals (SIGNAL IN3-0, SENSOR0, and SENSOR1) are assigned to a PAUSE signal, one or more axes can be simultaneously assigned by operating those signals.

The HARD CONFIGURATION4 command is used to assign the external input signals to the PAUSE signal.

〈Example of synchronously assigning X and Z axes with SENSOR0 signal as PAUSE signal〉



① Use the HARD CONFIGURATION4 command to assign a PAUSE signal to the SENSOR0 signal and select the axes (X and Z axes) that you want to synchronize with.

② When the SENSOR0 signal, an external signal, goes ON, the PAUSE signals go ON for the selected axes.
At this point, PAUSE=1 in MCC06 STATUS1 is assumed.

③ Write a general-purpose command that involves pulse output to the X and Z axes.

④ Confirm STATUS1 PORT STBY=1 on the X and Z axes.

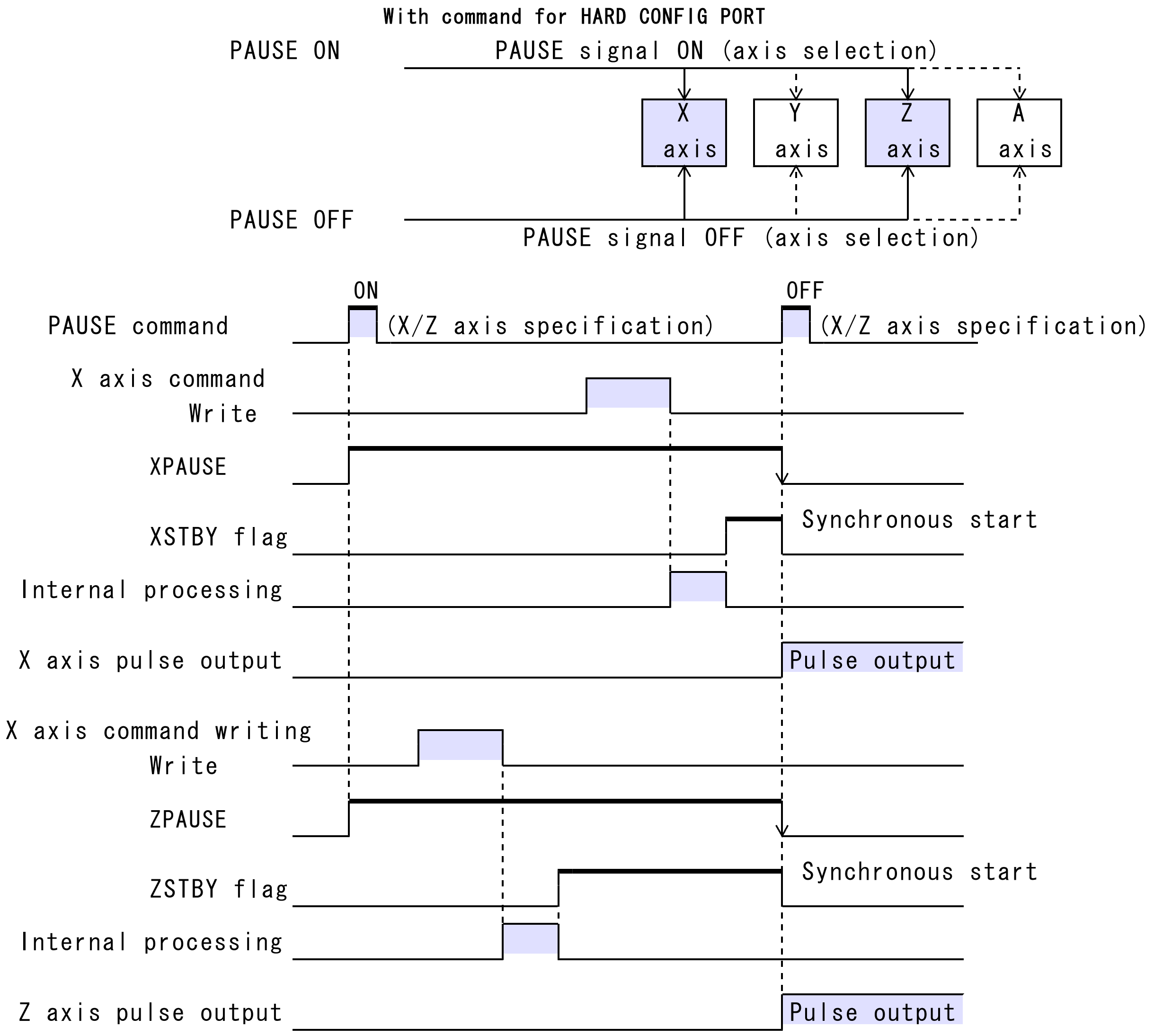
⑤ Set the SENSOR0 signal to OFF.
When the SENSOR0 signal is set to OFF, the PAUSE signals for the X and Z axes are simultaneously released.
At this point, the X and Z axes are simultaneously set to PAUSE=0 in MCC06 STATUS1 and start pulse output.

◆ After the PAUSE signal is set to ON in a PAUSE signal ON condition, the PAUSE state is held until a PAUSE releasing condition is met.
To execute a pulse output command that is once written with PAUSE ON, a PAUSE releasing condition needs to be met.
To cancel the pulse output command that is written during PAUSE, perform the following.
- Cancel the pulse output command in PAUSE with the FAST STOP command and release the PAUSE state by satisfying a PAUSE releasing condition (set to OFF the PAUSE CLR command, a selected releasing condition, or a signal that is assigned to PAUSE).
- Execute initialization with a RESET signal.

(2) Synchronous start with command

A PAUSE signal can be set to ON/OFF with the PAUSE command at the HARD CONFIG PORT.
The PAUSE command can be set for each axis to start one or more axes simultaneously.

〈Example of synchronous start of X and Z axes by setting PAUSE signal to ON/OFF with command〉



① Use the PAUSE SET SPEC command to set an X/Z axis PAUSE signal ON condition in the PAUSE command.
Use the PAUSE CLR SPEC command to set an X/Z axis PAUSE signal OFF condition in the PAUSE command.

② Use the PAUSE command to select the axes (X and Z axes) whose PAUSE signal you want to set to ON.

③ The PAUSE signals go ON for the axes that are selected by the PAUSE command.
At this point, PAUSE=1 in MCC06 STATUS1 is assumed.

④ Write to the X and Z axes a general-purpose command that involves pulse output.

⑤ Confirm STATUS1 PORT STBY=1 on the X and Z axes.

⑥ Use the PAUSE command to select the axes (X and Z axes) whose PAUSE signal you want to set to OFF.
Execute the PAUSE command to simultaneously release the PAUSE signals for the selected axes.
At this point, the X and Z axes are simultaneously set to PAUSE=0 in MCC06 STATUS1 and start pulse output.

◆ After the PAUSE signals are set to ON in a PAUSE signal ON condition, the PAUSE state is held until a PAUSE releasing condition is met.
To execute a pulse output command that is once written with PAUSE ON, a PAUSE releasing condition needs to be met.
To cancel the pulse output command, perform the following.

・Cancel the pulse output command in PAUSE with the FAST STOP command and release the PAUSE state by satisfying a PAUSE releasing condition (set to OFF the PAUSE CLR command, a selected releasing condition, or a signal that is assigned to PAUSE).
・Execute initialization with a RESET signal.

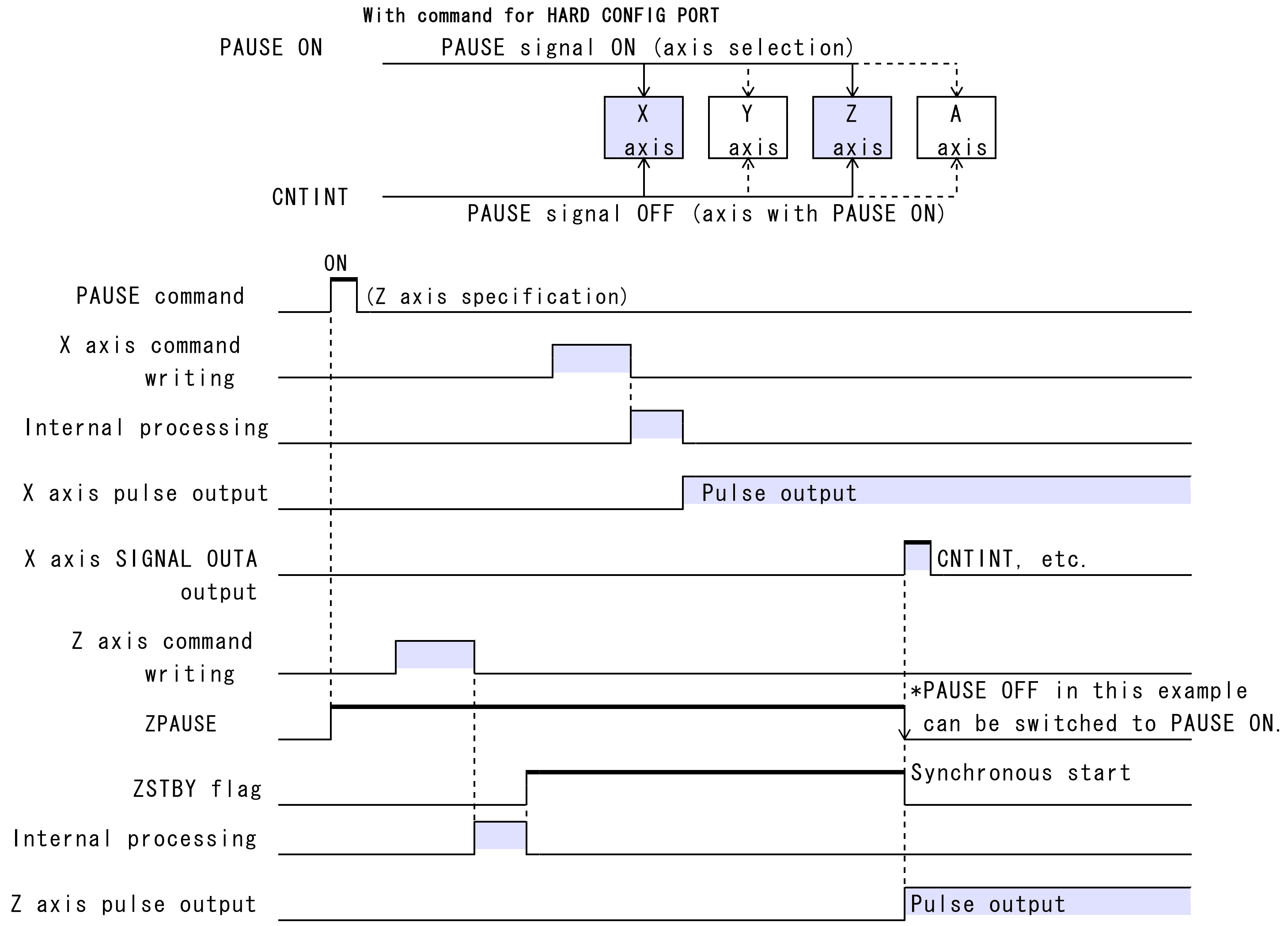
(3) Start synchronizing with counter signal

A PAUSE signal can be set to ON/OFF with SIGNAL OUTA and SIGNAL OUTB signals, which are interrupt request output signals of the counter.

PAUSE signals can be separately set to ON/OFF by using external signals and commands together.

- ◆ When a PAUSE signal is set to ON/OFF with a counter signal, the target axis is one that PAUSE signal assignment is set with the HARD CONFIGURATION4 command or that PAUSE signal assignment is set with the PAUSE ON/OFF command.
- ◆ If the PAUSE CLR SPEC and PAUSE SET SPEC settings are the same, PAUSE OFF (clearance) is given priority.

〈Example of setting PAUSE signal to ON with command and assigning Z axis with CNTINT for X axis〉



① Use the PAUSE SET SPEC command to set a PAUSE signal ON condition for the Z axis to PAUSE.

② Use the PAUSE CLR SPEC command to set a PAUSE signal OFF condition for the Z axis to SIGNAL OUTA (CNTINT) for the X axis.

③ Use the PAUSE command to select the axis (Z axis) whose PAUSE signal you want to set to ON.

④ A PAUSE signal goes ON for the axis that is selected by the PAUSE command.
At this point, PAUSE=1 in MCC06 STATUS1 is assumed.

⑤ Write a general-purpose command that involves pulse output to the X and Z axes.

⑥ The X axis starts pulse output. At this point, the Z axis remains at STATUS1 PORT STBY=1.

⑦ If a value that is set by the comparator for the X axis pulse counter reaches the pulse counter value, SIGNAL OUTA (CNTINT) is output. This signal releases a PAUSE signal for the Z axis.
At this point, PAUSE=0 in MCC06 STATUS1 for the Z axis is assumed and pulse output is started.

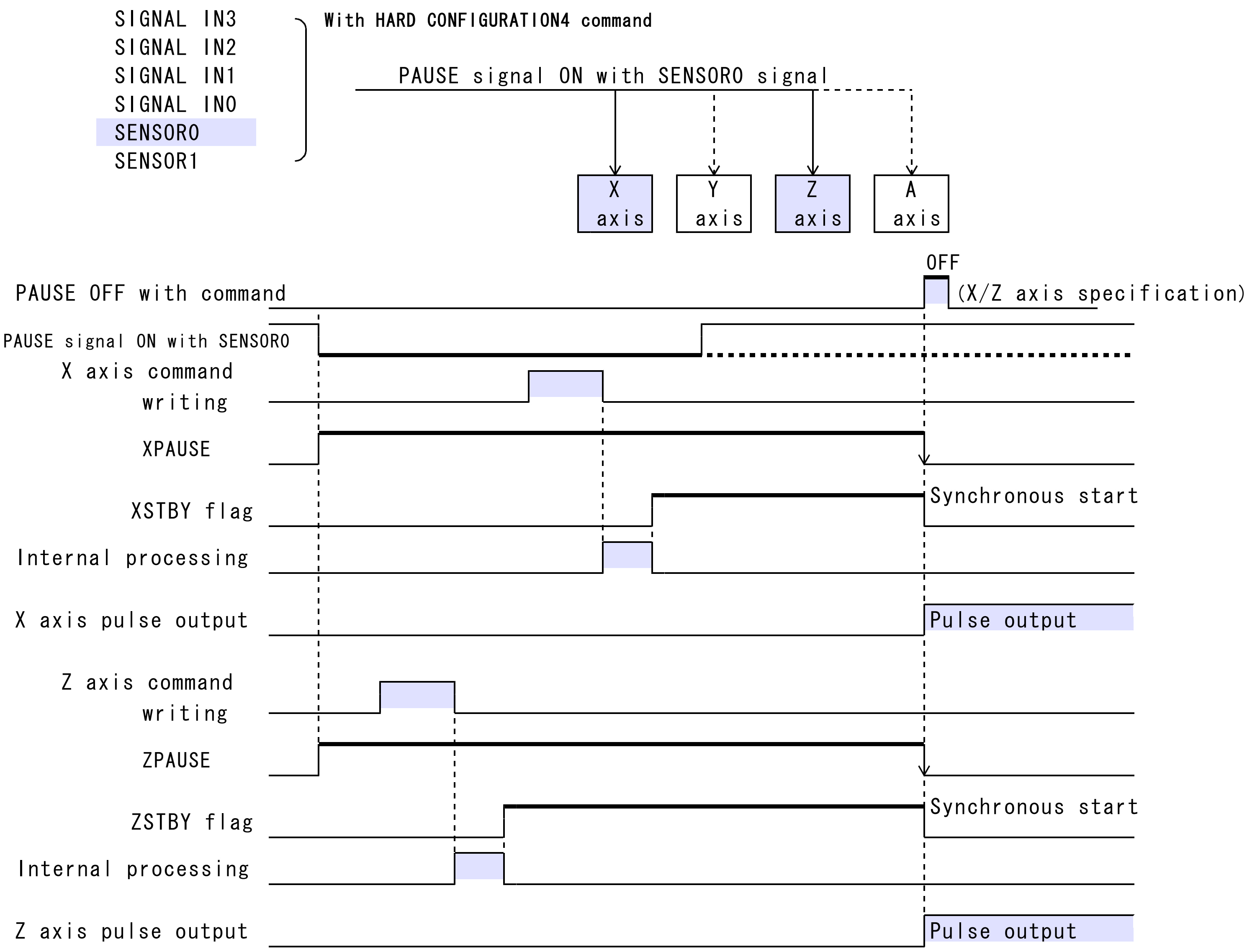
◆ After a PAUSE signal is set to ON in a PAUSE signal ON condition, the PAUSE state is held until a PAUSE releasing condition is met.
To execute a pulse output command that is once written with PAUSE ON, a PAUSE releasing condition needs to be met.
To cancel the pause output command, perform the following.
・Cancel the pulse output command in PAUSE with the FAST STOP command and release the PAUSE state by satisfying a PAUSE releasing condition (set to OFF the PAUSE CLR command, a selected releasing condition, or a signal that is assigned to PAUSE).
・Execute initialization with a RESET signal.

(4) Synchronous start with command, applying PAUSE with external input signal

PAUSE signals can be separately set to ON/OFF by using external signals and commands together.

〈Example of setting X and Z axes to PAUSE ON with SENSOR0 signal and synchronously starting X and Y axes with command〉

A PAUSE signal can be set to ON for four axes and to OFF for two or three axes with a command.



① Use the HARD CONFIGURATION4 command to assign a PAUSE signal to the SENSOR0 signal and select the axes (X and Z axes) that you want to synchronize with.

② Leave the PAUSE signal ON conditions for the X and Z axes in the PAUSE SET SPEC initial values.

③ Use the PAUSE CLR SPEC command to set the PAUSE signal OFF conditions for the X and Z axes to PAUSE command.

③ When the SENSOR0 signal, an external signal, goes ON, the PAUSE signal goes ON for the selected axes.
At this point, PAUSE=1 in MCC06 STATUS1 is assumed.

⑤ Write a general-purpose command that involves pulse output to the X and Z axes.

⑥ Confirm STATUS1 PORT STBY=1 on the X and Z axes.

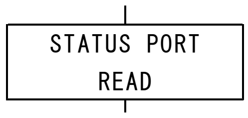
⑦ Use the PAUSE command to set the PAUSE signals for the X and Z axes to OFF.
When the PAUSE signals are set to OFF with the PAUSE command, the PAUSE signals for the X and Z axes are simultaneously released.
At this point, the X and Z axes are simultaneously set to PAUSE=0 in MCC06 STATUS1 and start pulse output.

◆ After a PAUSE signal is set to ON in a PAUSE signal ON condition, the PAUSE state is held until a PAUSE releasing condition is met.
To execute a pulse output command that is once written with PAUSE ON, a PAUSE releasing condition needs to be met.
To cancel the pulse output command, perform the following.
- Cancel the pulse output command in PAUSE with the FAST STOP command and release the PAUSE state by satisfying a PAUSE releasing condition (set to OFF the PAUSE CLR command, a selected releasing condition, or a signal that is assigned to PAUSE).
- Execute initialization with a RESET signal.

8-14. Reading Various Data

(1) Status reading function

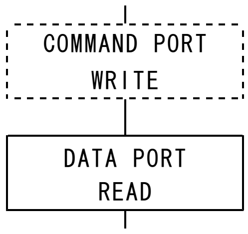
The current status of pulse control, interrupt request output, I/O signals, counter comparator output can be read in real-time.



① The status can be read at all times from the STATUS1-STATUS5 PORT.

(2) Speed data reading function

The current status of a drive pulse speed being output can be read in real-time.
This function is used to read set data or set error data in a reading port.



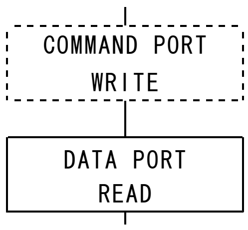
① By writing a command to a DRIVE COMMAND PORT, use a DRIVE DATA PORT as a speed data reading port.

② Read pulse speed data from the DRIVE DATA PORT.

Set this step to select another reading port.
When data is read from the same reading port, another setting is not required.

(3) Count data reading function

The current status of counter count data and counter latch data can be read in real-time.



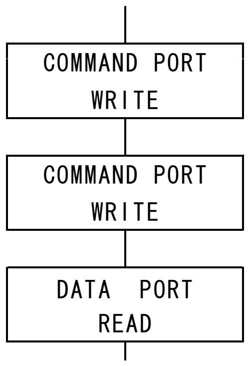
① By writing a command to the DRIVE COMMAND PORT, use a DRIVE DATA PORT as a counter reading port.

② Read counter data from the DRIVE DATA PORT.

Set this step to select another reading port.
When data is read from the same reading port, another setting is not required.

(4) Check function

Error details and set data can be confirmed by the check command.



① Write a check command to the DRIVE COMMAND PORT and specify the reading of error details or set data.

<Execution of DATA READ PORT SELECT command: H'F041>
② Write command H'F041 to the DRIVE COMMAND PORT.

③ Read a COMMAND CODE in an error occurrence or an ERROR CODE indicating error details from the DRIVE DATA PORT.

8-15. Using Various Counter Functions

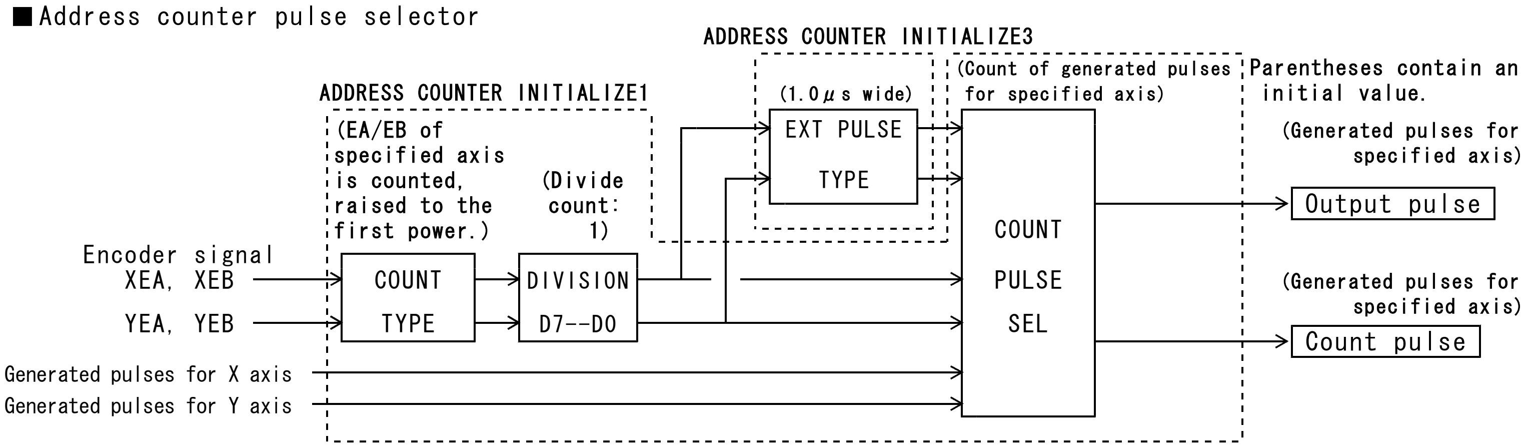
This section contains an explanation that is common to each axis. The first characters X, Y, Z, and A of each name are omitted.

(1) Address counter function

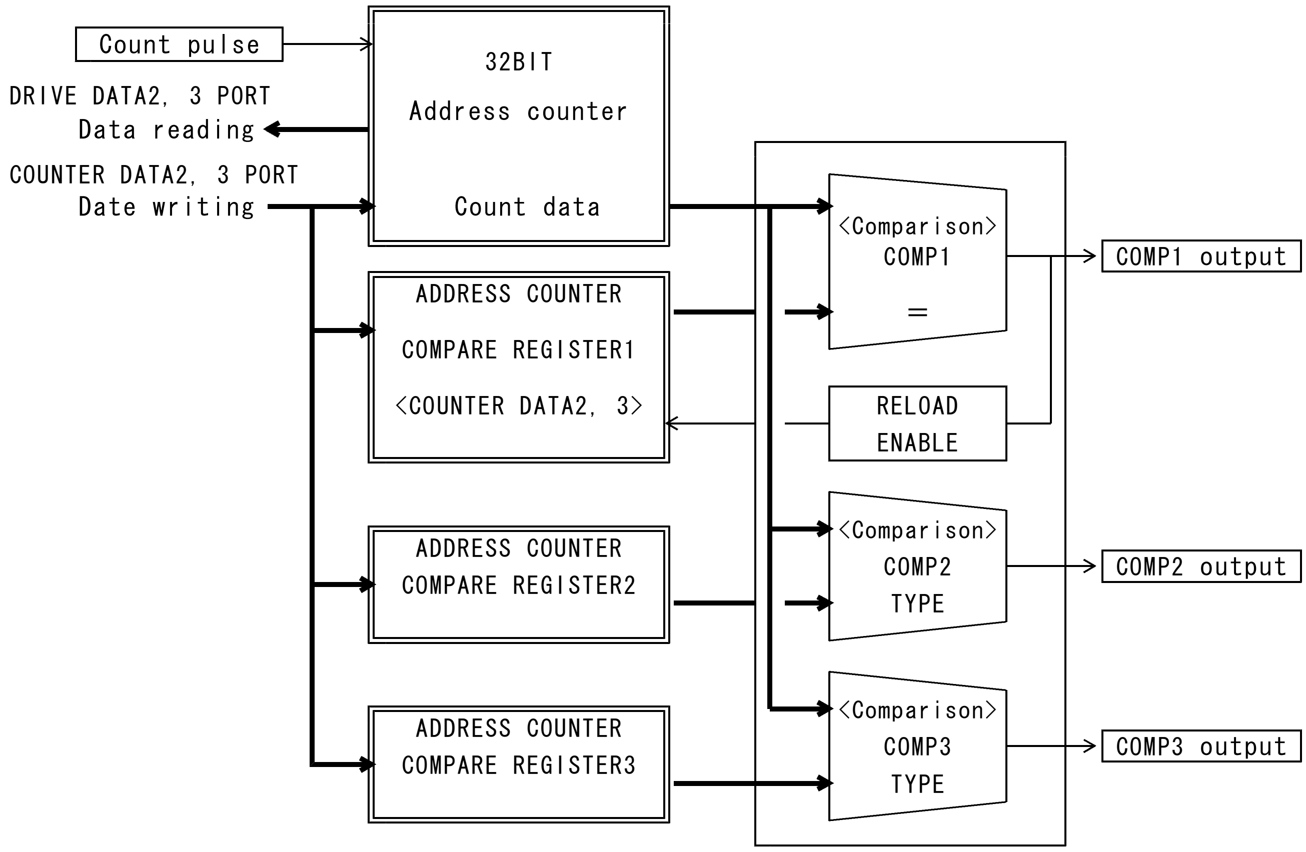
This is a 32 bit counter that counts drive pulses to be output to the CWP and CCWP signals and manages absolute addresses.

- ◆ The count increases with a + (CW) direction pulse and decreases with - (CCW) direction pulse.
- ◆ The effective area of the counter is from -2,147,483,647 to +2,147,483,647 (H'8000_0001 to H'7FFF_FFFF). A negative number is indicated by two's complement.
- ◆ If the effective area is exceeded, an overflow occurs, and STATUS4 PORT ADDRESS OVF=1 is assumed. Even if the overflow occurs, the counting function is valid and can be used as a ring counter. By optionally setting the maximum count of the counter (valid area), rotary system locations can be managed.

■Address counter pulse selector



■Address counter and comparator configurations

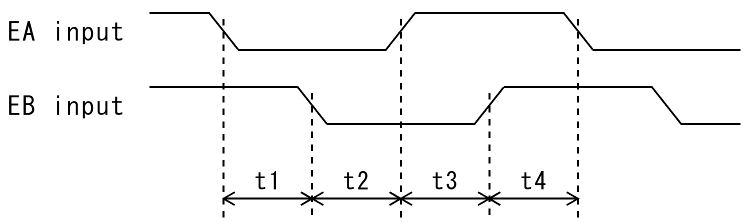


- ●Setting counter functions
  The counter and comparator functions are set with the ADDRESS COUNTER INITIALIZE1,2,3 command.
- ●Setting counter data
  The current value of the address counter is set with the ADDRESS COUNTER PRESET command.
- ●Count data is read and specified with the ADDRESS COUNTER PORT SELECT command.
  The data can be read at all times from a DRIVE DATA1,2,3 PORT.
- ●If the count pulse of the address counter is set to an encoder signal by using COUNT PULSE SEL of the ADDRESS COUNTER INITIALIZE1 command, the count timing of the encoder signal is converted to a pulse with a selected active width, which is output from the CWP and CCWP signals.

■Encoder signals input

The encoder signals input include two combinations of signal inputs: XEA,XEB and YEA,YEB.
Phase differential signals or pulse signals in independent direction can be input.

● Input timing of phase difference signal



●Address counter

・Digital filter initial value (100 ns)

When the multiplier is 2:t1, t2, t3, t4＞100 ns
t1＋t2＞200 ns、t3＋t4＞200 ns

When the multiplier is 4：t1, t2, t3, t4≧200 ns

・When set to 0 by digital filter applied function

When the multiplier is 2:t1, t2, t3, t4＞50 ns
t1＋t2≧200 ns、t3＋t4≧200 ns

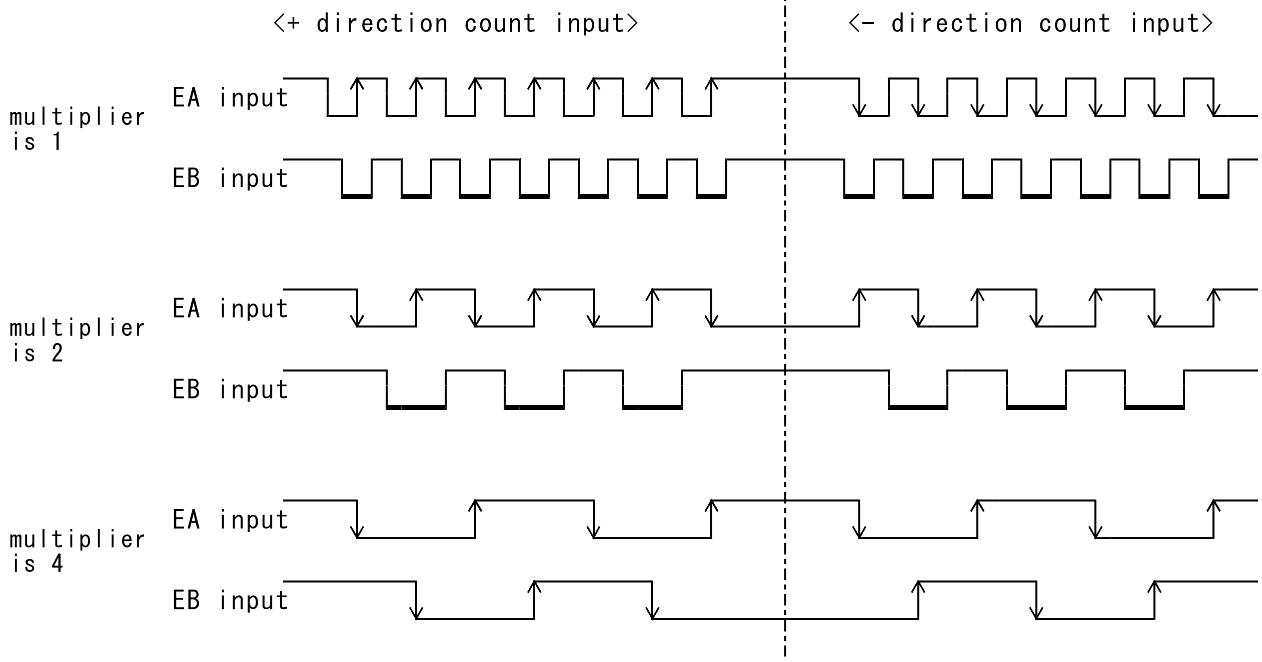
When the multiplier is 4：t1, t2, t3, t4≧200 ns

●Other counters

・Digital filter initial value (100 ns)
t1, t2, t3, t4＞100 ns

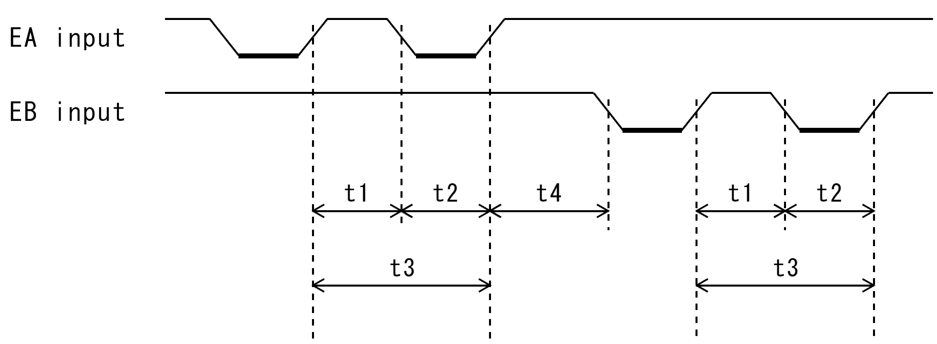
・When set to 0 by digital filter applied function
t1, t2, t3, t4＞50 ns

Count edge (arrow mark)



● Input timing of pulse signals in independent directions

The pulse signals in independent directions are counted as negative logic pulses.



●Address counter

・Digital filter initial value (100 ns)
t1, t2, t4＞100 ns
t3＞200 ns

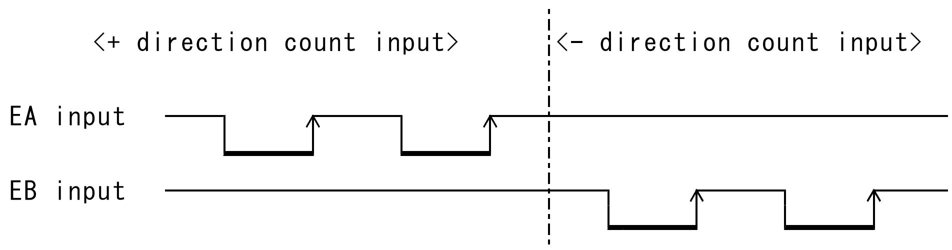
・When set to 0 by digital filter applied function
t1, t2, t4＞50 ns
t3≧200 ns

●Other counters

・Digital filter initial value (100 ns)
t1, t2, t4＞100 ns
t3＞200 ns

・When set to 0 by digital filter applied function
t1, t2, t4＞50 ns
t3＞100 ns

Count edge (arrow mark)



■Encoder signal output function

Set this function with the ADDRESS COUNTER INITIALIZE1 command.

When an address counter count pulse is set to an encoder signal, the count timing of that encoder signal is converted to a pulse with an active width selected by EXT PULSE TYPE and output from the CWP and CCWP signals.

◆ Even when an encoder signal is being output, the encoder signal pulse output is stopped while a immediate stop command is active.

◆ When the encoder signal pulse output is active, if the immediate stop command becomes active, the active width of the encoder signal pulse being output is secured and then the pulse output is stopped.

◆ When EXT PULSE=1, the following flags of the STATUS1 PORT are valid.

・BUSY, STBY, DRIVE, ERROR, LSEND, FSEND

◆ General-purpose command writing, the synchronous start function, and servo driver support by the DRST and DEND functions are invalid.

◆ A status flag in encoder signal pulse output changes as follows.

・COUNT PULSE SEL of the ADDRESS COUNTER INITIALIZE1 command is set to an external pulse signal, EXT PULSE=1, BUSY=1, STBY=1, and DRIVE=0 are assumed.

・When the output of an encoder signal pulse is started, STBY=0 and DRIVE=1 are assumed.

・When the output of the encoder signal pulse is stopped with the immediate stop command, STBY=1 and DRIVE=0 are assumed.

・When the output of the encoder signal pulse is started after the immediate stop command is canceled, STBY=0 and DRIVE=1 are assumed.

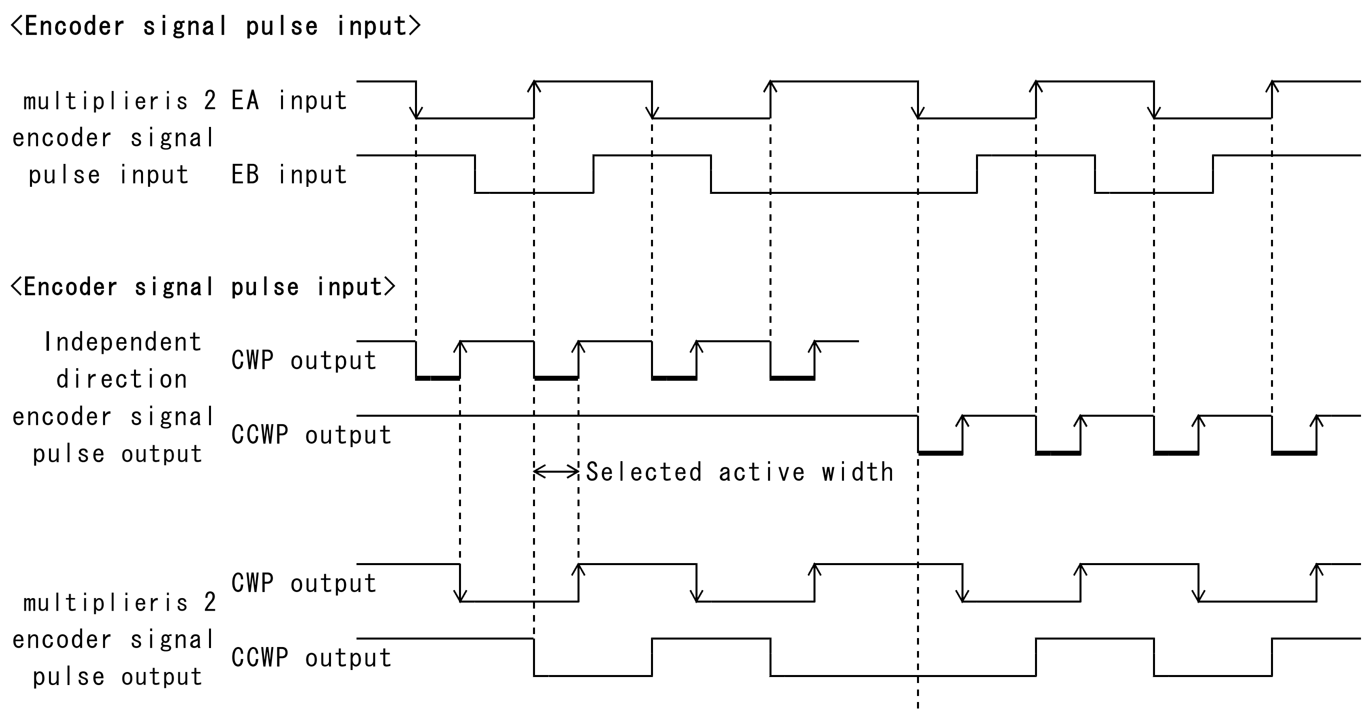
・When COUNT PULSE SEL is set to a generated pulse on the own axis, EXT PULSE=0 and BUSY=0 are assumed.

Do not set COUNT PULSE SEL to 00 when the immediate stop command is active.

*See notes on the encoder signal output function.

◆ When the next count timing is reached within a time two times an active width that is selected by EXT PULSE TYPE, normal pulse output is invalid.

In this case, STATUS1 PORT ERROR=1 is assumed. Even at ERROR=1, external pulse output is not stopped.

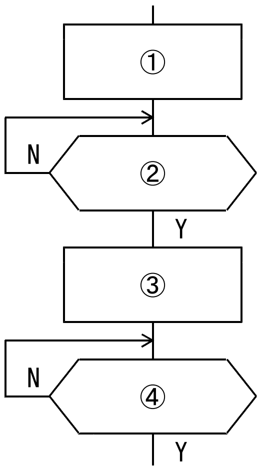


・When the multiplieris 2 phase difference signal is output, a selected active width becomes the phase difference of the output signal.

■Notes on encoder signal output function

COUNT PULSE SEL of the ADDRESS COUNTER INITIALIZE1 command is set to "00: generated pulse on own axis" when the immediate stop command is active with STATUS1 PORT EXT PULSE=1, EXT PULSE=0 and BUSY=0 cannot be put back and a subsequent operation is disabled.
To return to BUSY=0 after the pulse output is stopped with the immediate stop command, perform the following.

● When the pulse output is stopped with the LIMIT immediate stop command while in operation at EXT PULSE=1



① Escape from LIMIT by outputting an external pulse in the reverse direction.

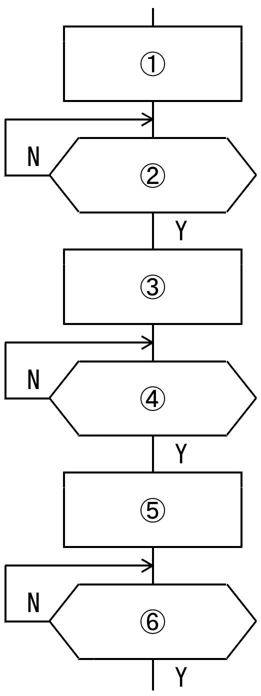
② Confirm that the CWLM and CCWLM flags at the STATUS2 PORT are 0.

③ Set COUNT PULSE SEL of the ADDRESS COUNTER INITIALIZE1 command to 00.

④ Confirm that the BUSY flag at the STATUS1 PORT is 0.

● When the pulse output is stopped with a non-LIMIT immediate stop command while in operation at EXT PULSE=1
Although BUSY=0 can be put back like the LIMIT immediate stop by canceling the immediate stop command, safety needs to be considered to do so.
If safety cannot be secured, execute initialization as follows.

<Initialization with SOFT RESET command>
If either of the X and Y or Z and A axes with BUSY=1 can be set to BUSY=0, execute the SOFT RESET command for the other axis.
Initialization is executed, similar to reset, for MCC06 (a couple of axes for which the command is executed).



① Write H'8000 to the DRIVE DATA3 PORT of the other axis.

② Confirm that the BUSY flag at the STATUS1 PORT of the other axis is 0.
If the other axis is at BUSY=1, set it to BUSY=0.

③ Write H'0003 to the DRIVE COMMAND PORT of the other axis.

④ Confirm that the BUSY flag at the STATUS1 PORT of the other axis is 0.

⑤ Write H'000F to the DRIVE COMMAND PORT of the other axis.

⑥ Confirm that the BUSY flag at the STATUS1 PORT of the X and Y (or Z and A) axes are 0.

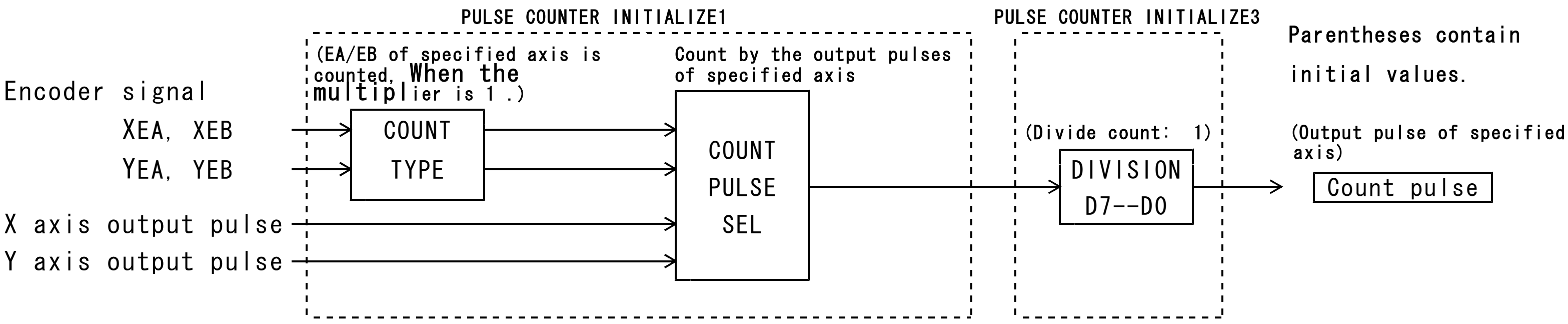
<Initialization by hardware reset>
If both X and Y (or Z and A) axes cannot be put back to BUSY=0, enter RESET from the RESET signal at the J1 connector of the C-V870.
This signal initializes the C-V870 (all of the four axes).

(2) Pulse counter function

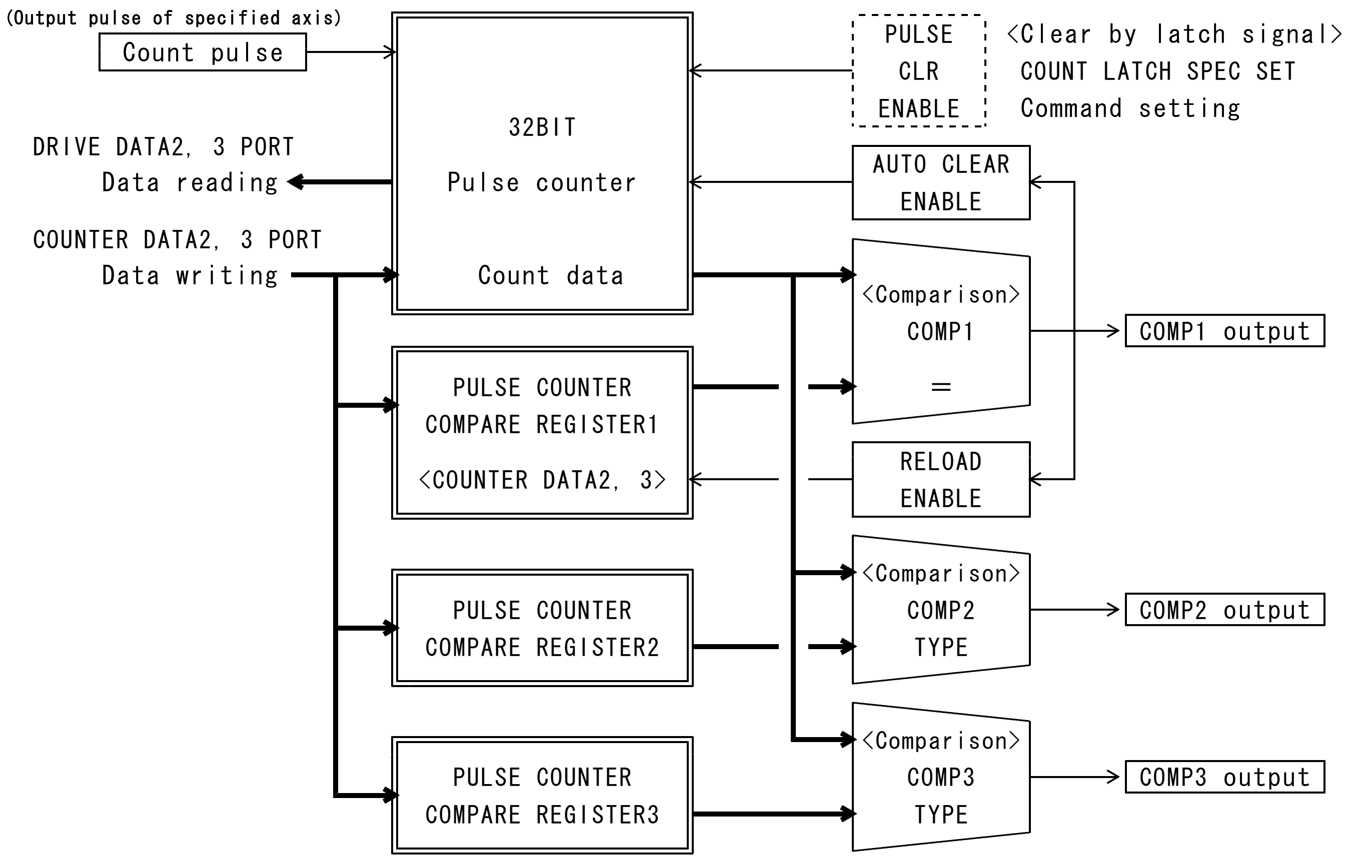
This is a 32 bit counter that manages real locations by counting encoder signals (external pulses).

- ◆ The count increases with a + direction pulse and decreases with a - direction pulse.
- ◆ The effective area of the counter is from -2,147, 483, 647 to +2, 147, 483, 647 (H'8000_0001 to H'7FFF_FFFF). A negative number is indicated by two's complement.
- ◆ If the effective area is exceeded, an overflow occurs, and STATUS4 PORT PULSE OVF=1 is assumed. Even if the overflow occurs, the counting function is valid and can be used as a ring counter. By optionally setting the maximum count of the counter (valid area), rotary system locations can be managed.

■Pulse selector



■Pulse counter and comparator configuration



●Setting counter function

The counter and comparator functions are set with the DRIVE COMMAND.
See the PULSE COUNTER INITIALIZE1,2,3 command.

●Data setting of counter

Set the initial value of the pulse counter with PULSE COUNTER PRESET.
Set comparator data with PULSE COUNTER COMPARE REGISTER1,2,3 SET.

●Read count data with the PULSE COUNTER PORT SELECT command and specify it.

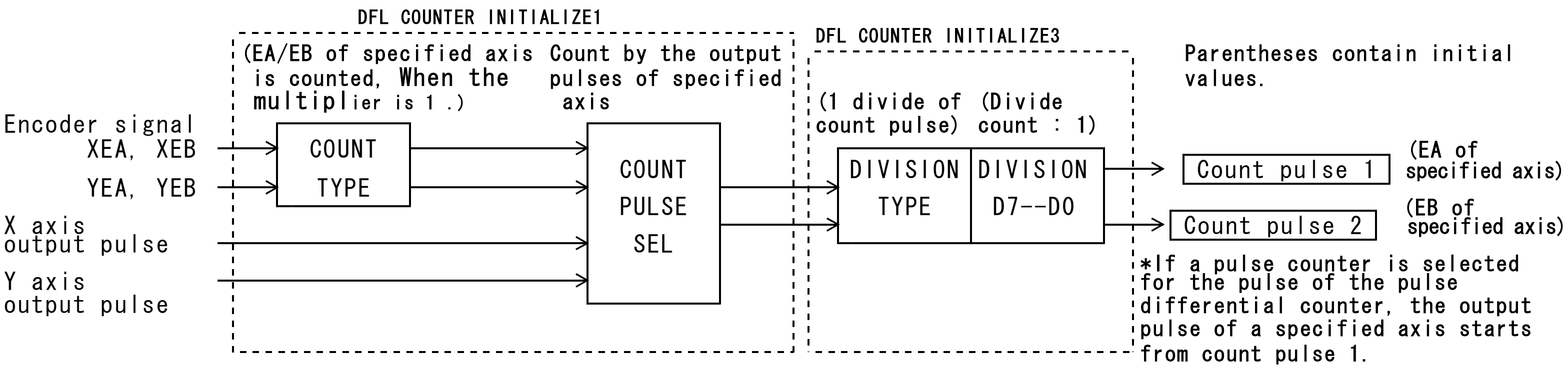
The data can be read at all times from the DRIVE DATA1,2,3 PORT.

(3) Pulse differential counter function

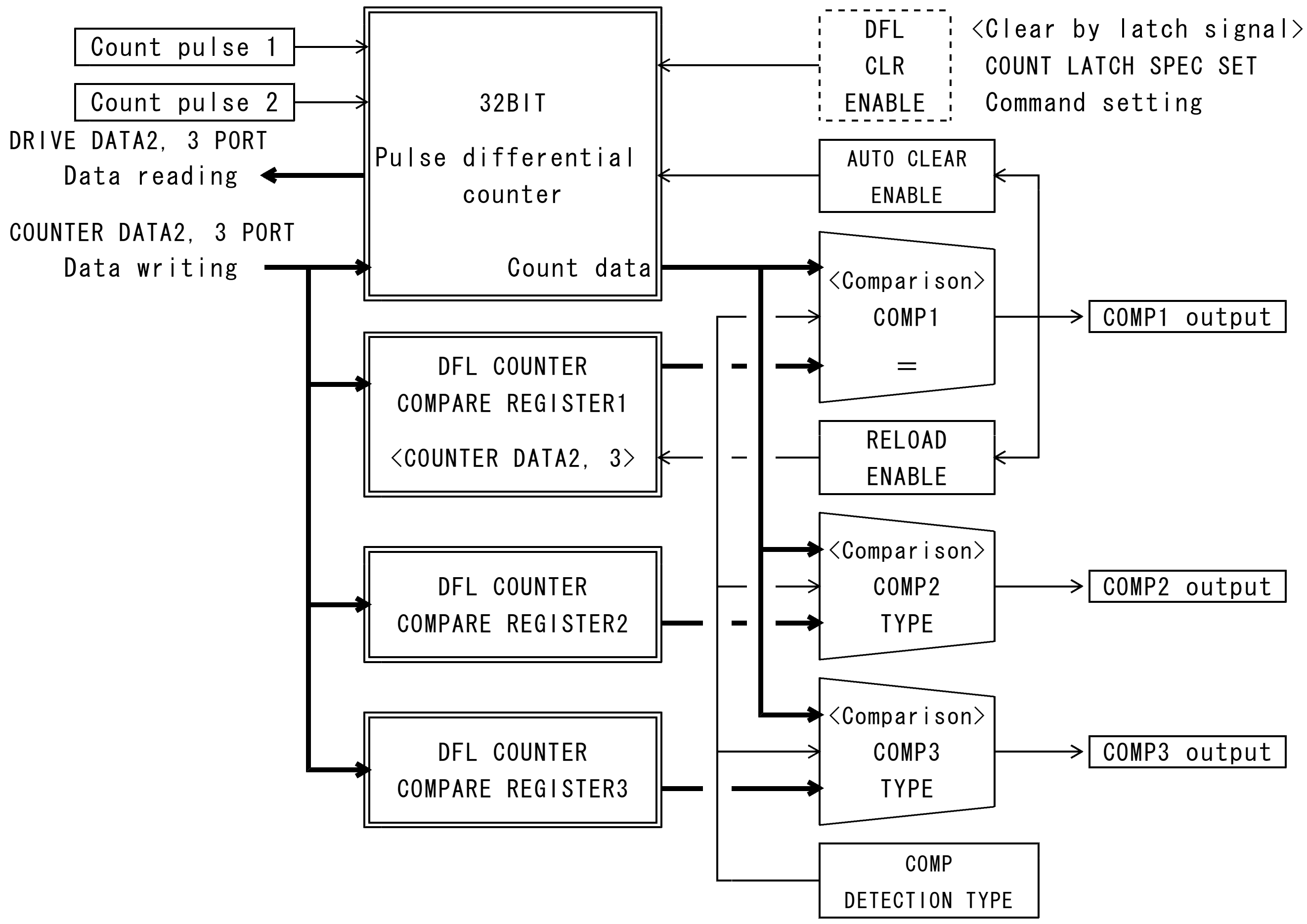
This is a 32 bit counter that detects the differential number of pulses by counting two types of optional pulses.
It can also be used as a pulse counter that counts one type of optional pulses.

- ◆ Select optional pulses from encoder signals (external pulses) and drive pulses output. The count pulse is as follows.
  - ・Count pulse 1 of the differential counter increases the count in the + direction and decreases it in the - direction.
  - ・Count pulse 2 of the differential counter increases the count in the - direction and decreases it in the + direction.
  - ・The count pulse of the pulse counter increases the count in the + direction and decreases it in the - direction.
- ◆ The effective area of the counter is from -2,147, 483, 647 to +2,147,483,647 (H'8000_0001 to H'7FFF_FFFF). A negative number is indicated by two's complement.
- ◆ If the effective area is exceeded, an overflow occurs, and STATUS4 PORT DFL OVF=1 is assumed. Even if the overflow occurs, the counting function is valid and can be used as a ring counter. By optionally setting the maximum count of the counter (valid area), rotary system locations can be managed.

■Pulse selector for pulse differential counter



■Pulse differential counter and comparator configuration



●Setting counter function
Set the counter and comparator functions with the DFL COUNTER INITIALIZE1,2,3 SET.

●Data setting of counter
Set the initial value of the pulse differential counter with the DFL COUNTER PRESET command.
Set comparator data with the DFL COUNTER COMPARE REGISTER1,2,3 SET.

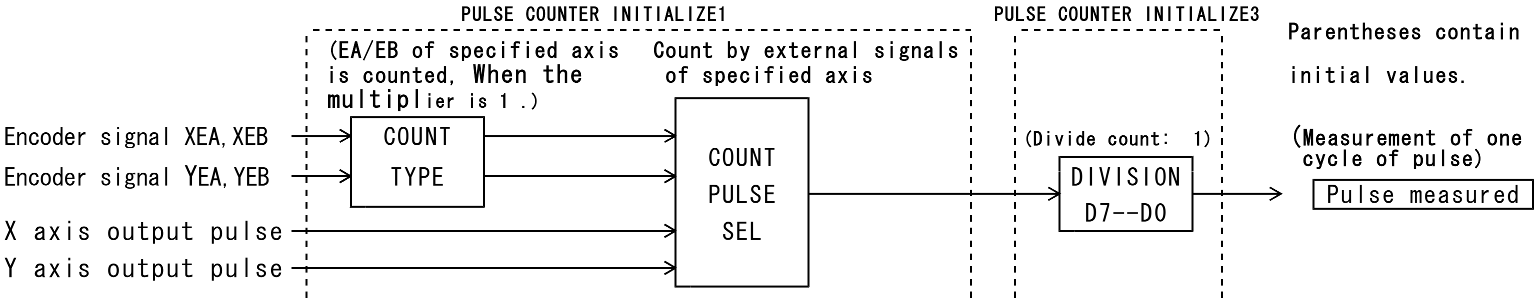
●Read count data with the DFL COUNTER PORT SELECT command and specify it.
The data can be read at all times from the DRIVE DATA1,2,3 PORT.

(4) Pulse cycle counter function

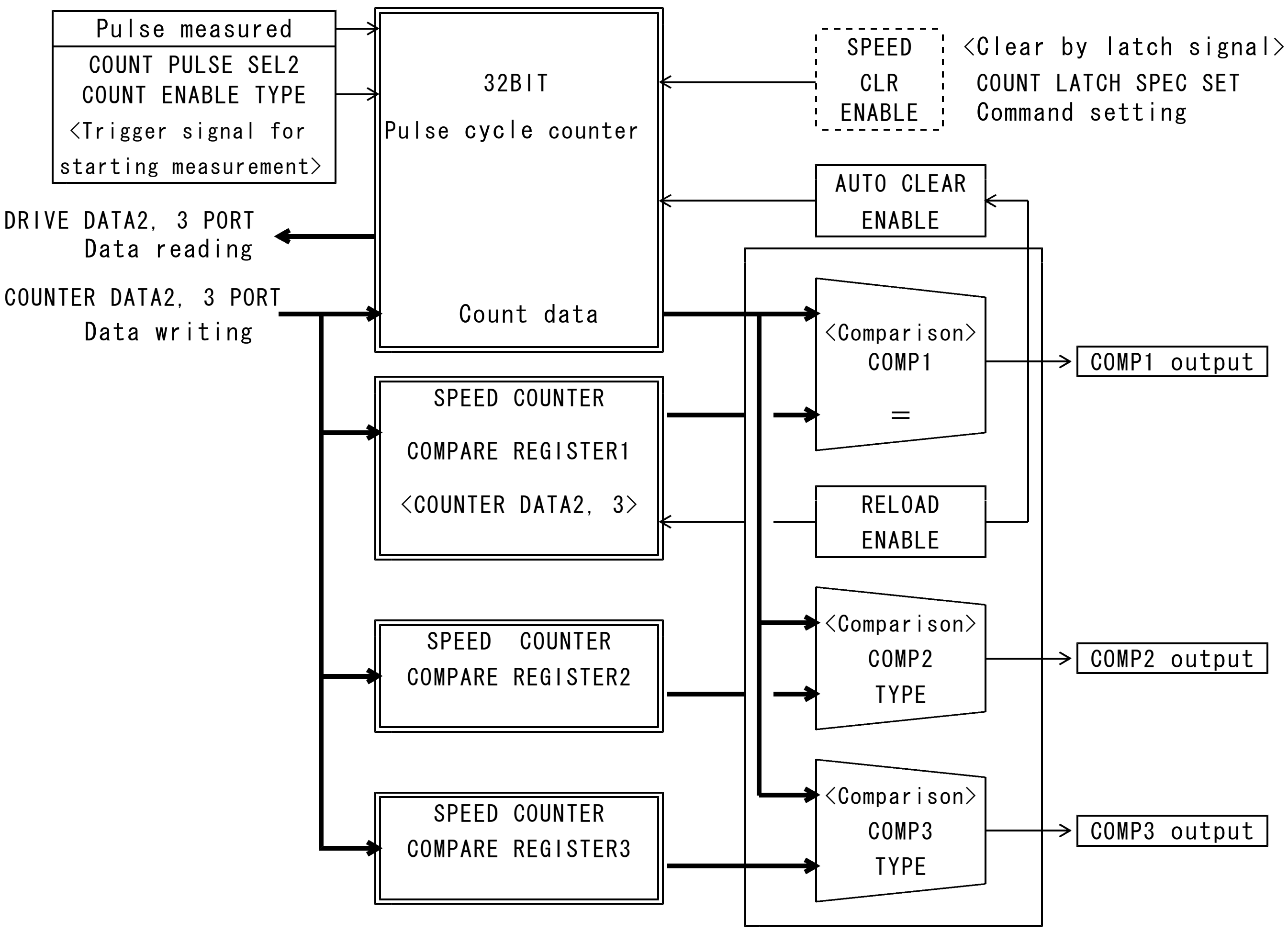
This is a 32 bit counter that measure one cycle of an optional pulse by counting 20 MHz reference clocks.
This counter can be used as a 32 bit timer because it measures the time.

- ◆ Select an optional pulse from encoder signals (external pulses) and drive pulses output.
- ◆ When the counter is used to measure one cycle, it is put on stand-by for measurement by detecting an optional trigger signal.
  When the count timing of a pulse to be measured is reached, this counter starts measurement.
  When one cycle is measured, this counter latches and saves the data. At the same time, it clears the count and starts the next measurement.
- ◆ When this counter is used as a timer, it starts measurement, detecting an optional trigger signal.
  When the count timing of a pulse to be measured is reached, this counter latches and saves measurement data.
  The counter is not cleared. The latched data is an accumulation of measurement.
- ◆ The effective area of the counter is from 4 to 4,294,967,294 (H'0000_0004 to H'FFFF_FFFE).
  Read the measurement data of one cycle with the SPEED COUNTER PORT SELECT command and specify it.
  The data can be read at all times from the DRIVE DATA1,2,3 PORT.
- ◆ If the effective area is exceeded, an overflow occurs, and STATUS4 PORT SPEED OVF=1 is assumed.
  The overflow count (maximum value) of the counter can be optionally set.

■Pulse selector for pulse cycle counter



■Pulse cycle counter and comparator configuration



● Setting counter function

Set the counter and comparator functions with the DRIVE COMMAND.
See the SPEED COUNTER INITIALIZE1,2,3 command.

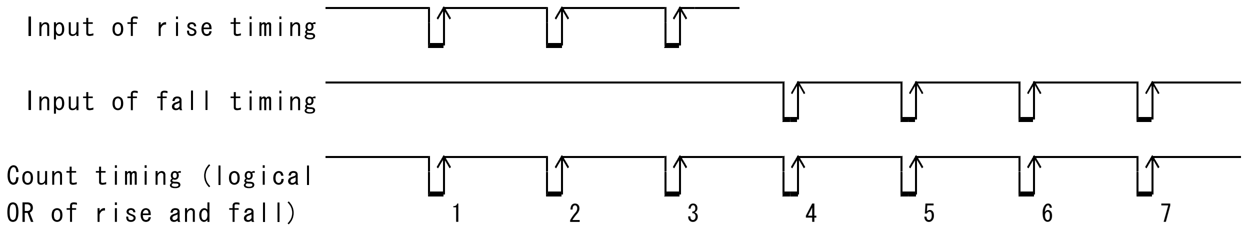
● Data setting of counter

Set counter and comparator data with the COUNTER COMMAND.
See "Data setting of pulse cycle counter."

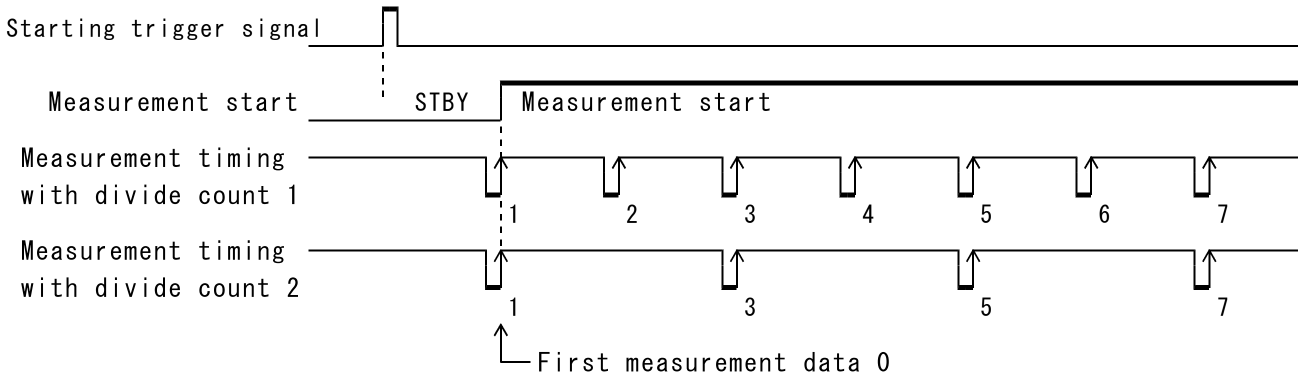
■ Dividing function and measurement timing of pulse cycle counter

The count timing cycle of a pulse that is selected by COUNT PULSE SEL is divided and measured.

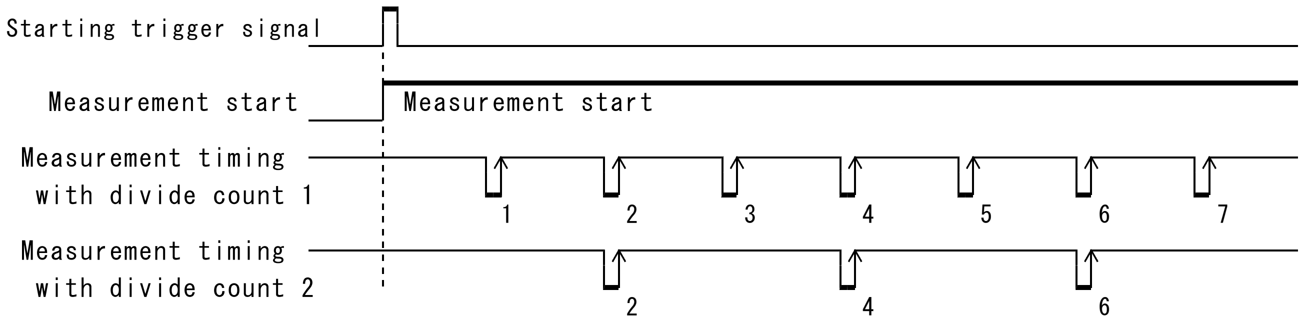
● Count timing of pulse to be measured



● Measurement timing of COUNT PULSE SEL2 = 0 (measurement of one cycle of pulse)



● Measurement timing of COUNT PULSE SEL2 = 1 (used as a timer)



■ Speed conversion expression for latch data

V ＝ F／D	: V ＝ latch data speed (Hz)
	: D ＝ latch data
Error (%) ＝ (1／D) x 100	: F ＝ 20,000,000 (Hz)

The resolution of the pulse cycle counter is 50 ns. Speed measurement has an error of ±50 ns. If a higher accuracy is required, extend the measurement cycle using the dividing function.

■ Data setting of pulse cycle counter

The measurement data of the pulse cycle counter is a count of 20 MHz clocks.
To write to the COUNTER DATA1,2,3 PORT and COUNTER COMMAND PORT, set a Compare register detection value and overflow counter value.

(5) Counter data latch and clearance functions

■ Counter latch function

This function latches the count data of a counter at the active edge of a latch timing set.
The latched data is saved until the active edge of the next latch timing is reached.
The latched data is read from the DRIVE DATA1,2,3 PORT (READ).
When the data is read from the reading port, the data of the DRIVE DATA3 PORT is read last.
When the data of the DATA1 or DATA2 PORT is read, the data of the DATA1,2,3 PORT is saved.
When the data of the DATA3 PORT has been read, the data of the DATA1,2,3 PORT is updated.

In-measurement count data can be read with the count data latch and clearance functions.

◆ The resolution of the pulse cycle counter is 50 ns. Speed measurement has an error of ±50 ns.

◆ If a higher accuracy is required, extend the measurement cycle using the dividing function.

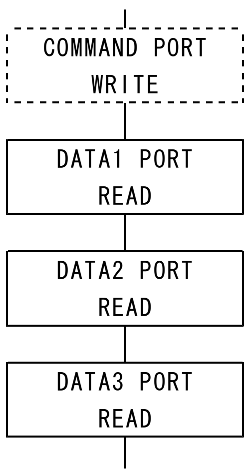
● Latch count

Read data is from 0 to 65,535 (H'0000 to H'FFFF).
A data latch count is indicated at a latch timing set.
When 65,535 is exceeded, the latch count is reset to 0.
When the COUNT LATCH SPEC SET command is executed, the latch count is reset to 0.

■ Counter clearance function

The counter clearance function at latch timing is provided in the pulse counter, pulse differential counter, and pulse cycle counter.
Counter data is reset to 0 at the same time as count data is latched.
If the clearance function is enabled at the count timing of the counter, the clearance function is given priority.

■ Execution sequence for reading latch data

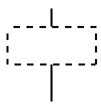


① Write a command to the DRIVE COMMAND PORT.

② Read latch counts D15 to D0 from the DRIVE DATA1 PORT.

③ Read latch data D31 to D16 from the DRIVE DATA2 PORT.

④ Read latch data D15 to D0 from the DRIVE DATA3 PORT.

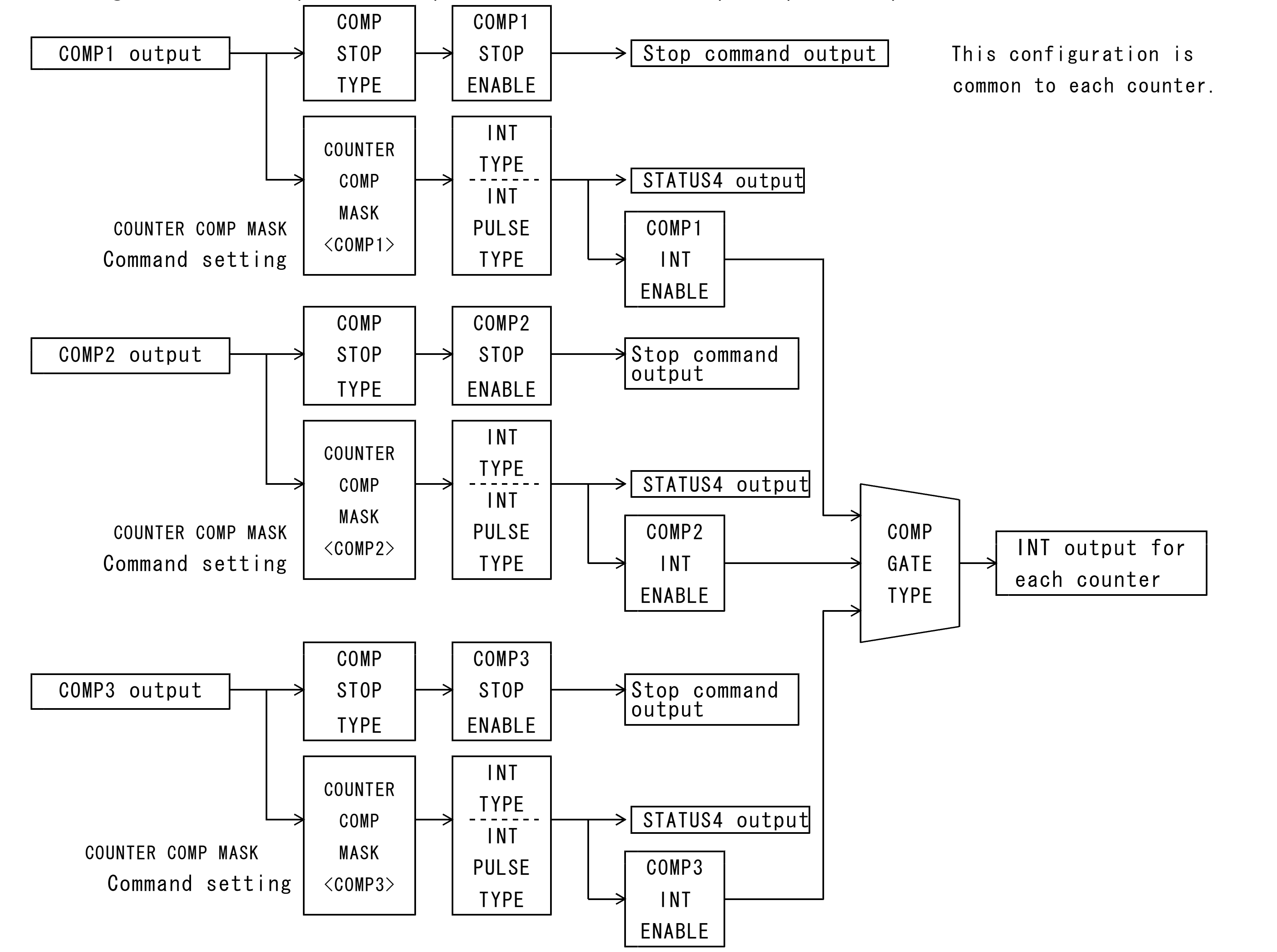


Set this step to select another reading port.
When data is read from the same reading port, another setting is not required.

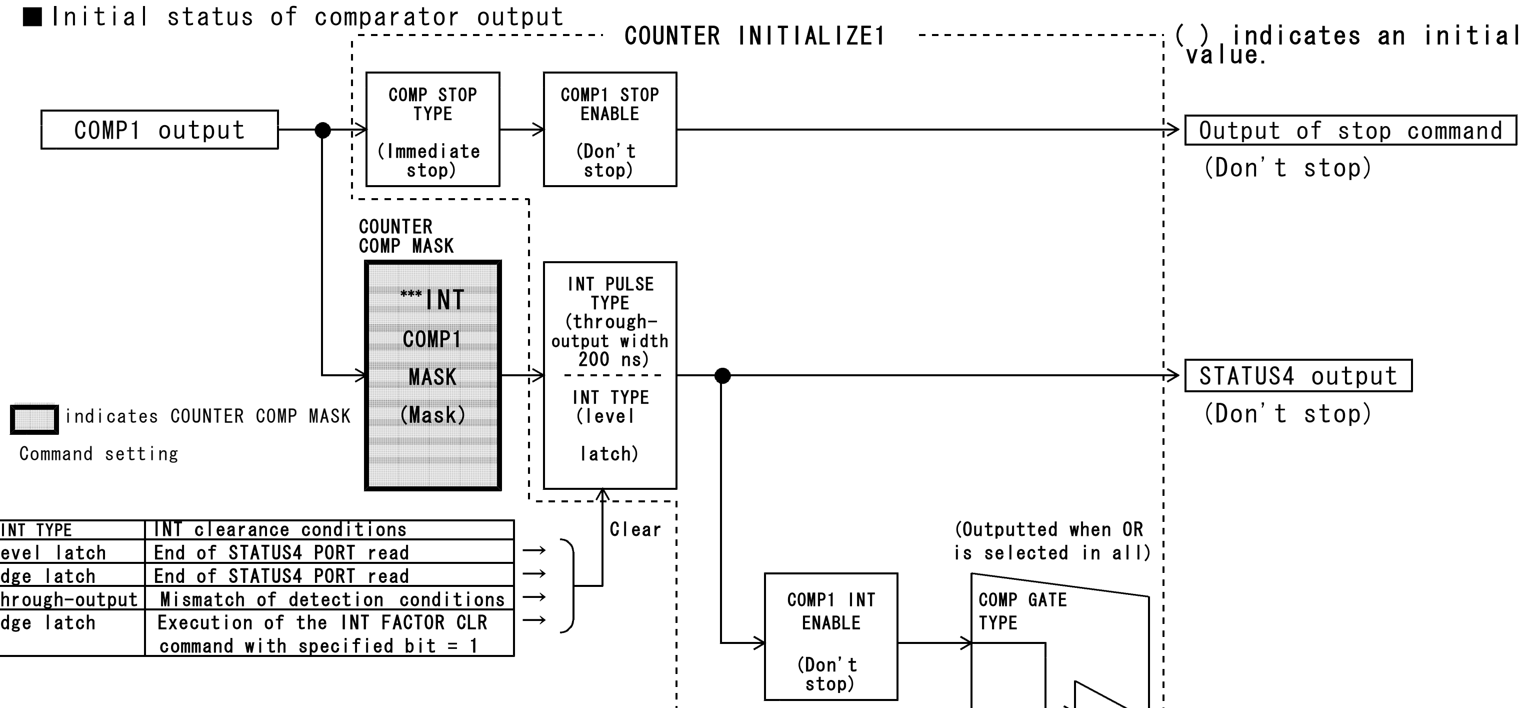
(6) Counter comparator function

Each counter has three dedicated comparators. If a detection condition is met by comparing the counter value with COMPARE REGISTERS 1, 2, 3, a signal is output at the ON level. The output status can be checked at the STATUS4 PORT.

■ Configuration of comparator output and counter interrupt request output



■ Initial status of comparator output



INT TYPE	INT clearance conditions
Level latch	End of STATUS4 PORT read
Edge latch	End of STATUS4 PORT read
Through-output	Mismatch of detection conditions
Edge latch	Execution of the INT FACTOR CLR command with specified bit = 1

● Same configuration for COMP2 and COMP3

COMP2 output

COMP3 output

■Specifications and clearance method of comparator output

Comparator output		Output specification	Clearance method
		Address counter	<Selection>
ADRINT	COMP1	・COMP1 detection condition true	・Clear by detection condition false
	COMP2	・COMP2 detection condition true	・Clear at the end of STATUS4 PORT reading
	COMP3	・COMP3 detection condition true	・Clear by INT FACTOR CLR command
		Pulse counter	<Selection>
CNTINT	COMP1	・COMP1 detection condition true	・Clear by detection condition false
	COMP2	・COMP2 detection condition true	・Clear at the end of STATUS4 PORT reading
	COMP3	・COMP3 detection condition true	・Clear by INT FACTOR CLR command
		Pulse differential counter	<Selection>
DFLINT	COMP1	・COMP1 detection condition true	・Clear by detection condition false
	COMP2	・COMP2 detection condition true	・Clear at the end of STATUS4 PORT reading
	COMP3	・COMP3 detection condition true	・Clear by INT FACTOR CLR command
		Pulse cycle counter	<Selection>
SPDINT	COMP1	・COMP1 detection condition true	・Clear by detection condition false
	COMP2	・COMP2 detection condition true	・Clear at the end of STATUS4 PORT reading
	COMP3	・COMP3 detection condition true	・Clear by INT FACTOR CLR command

●The detection condition of comparator COMP1 is "Counter value = COMPARE REGISTER1 value."
Select the detection conditions of comparators COMP2 and COMP3 from ≧, ≦, and =.
The counter value detection methods for the DFL counter include absolute value detection and signed detection.
Set a comparator detection condition in COMP TYPE of the COUNTER INITIALIZE2 command.

●Comparators COMP1, COMP2, and COMP3 have the following output functions.

・The match output of a comparator can be selected from level latch output, edge latch output, and through-output.
・Pulse output can be put into slow or immediate stop by the match output of the comparator.
・COMP1, COMP2, and COMP3 can be output in combination to counter interrupt request SIGNAL OUTA/B.
・The match output of COMP1 includes a counter AUTO CLEAR function (*1) and detected-data reload function.

Set these functions with the COUNTER INITIALIZE1 command.

*1 An address counter is excluded.

●By setting the count data latch and clearance functions, count data can be latched and cleared by detecting a latch timing.
Read latch data with the DFL LATCH PORT SELECT command and specify it.
The data can be read at all times from the DRIVE DATA1,2,3 PORT.

■ AUTO CLEAR function

When the match output of COMP1 is detected, the pulse counter, pulse differential counter, and pulse speed counter are reset to 0.
When the match output of COMP1 is through, its data is output with the minimum output width of the match output.
Although this counter part has an initial output width of 200 ns, its data can be trigger-output with the output width extended up to 65.535 ms by setting the output with the HARD CONFIGURATION COMMAND.

■ Reload function

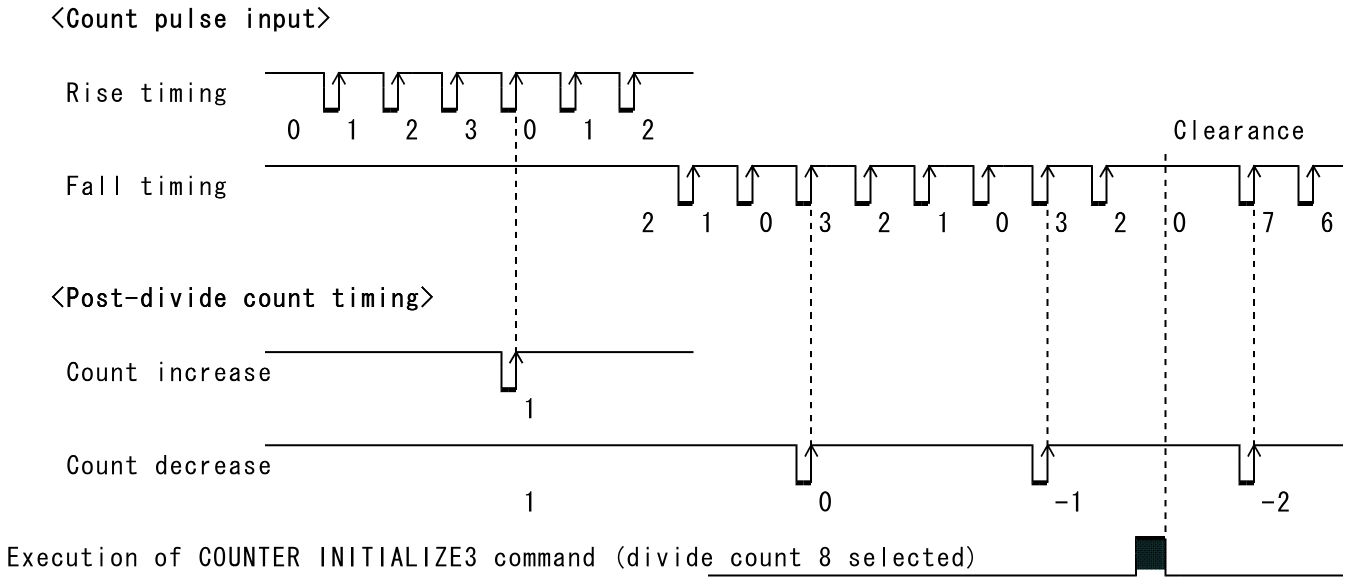
When the match output of COMP1 is detected, the data that is stored in the COUNTER DATA2,3 PORT is set again in COMPARE REGISTER 1.
When the match output of COMP1 is through, its data is output with the minimum output width of the match output.
Although this counter part has an initial output width of 200 ns, its data can be trigger-output with the output width extended up to 65.535 ms by setting the output with the HARD CONFIGURATION COMMAND.

(7) Other counter functions

■ Count by divided pulse (divide count: 4)
The count timing of COUNT PULSE SEL output pulses selected by SPEC INITIALIZE1 of each counter can be divided.
The counter counts in either an increasing direction or a decreasing direction at a divided time.
Make this setting with the COUNTER INITIALIZE3 command of each counter.

●For encoder signals (external pulses), a counting time that is multiplire by COUNT TYPE is divided.

●When the COUNTER INITIALIZE3 command is executed, a divide count being used is cleared.



■ Setting maximum count

If a maximum count is set in each counter, a ring count starts with the set value as the maximum value of the counter.
If the OVF flag of each counter at the STATUS4 PORT is ignored, rotary system locations can be managed.
Set a maximum value with the COUNTER MAX COUNT SET command.

When the count reaches half of the set value, OVF=1 of each counter at the STATUS4 PORT is assumed.
Even if a maximum count is set, the current value of each counter remains unchanged.
The setting becomes valid when the value of each counter falls within the maximum count.

● **Maximum count = 1,999** (one rotation by 2,000 counts)
+ direction count:0→1→…→999→1000 (STATUS4 PORT OVF = 1)→1001→…→1999→0
- direction count:0→1999→…→1001→1000 (STATUS4 PORT OVF = 1)→999→…→1→0

● **Maximum count = 2,000** (one rotation by 2,001 counts)
+ direction count:0→1→…→1000→1001 (When set to 1001, it is STATUS4 PORT OVF = 1)→…→2000→0
- direction count:0→2000→…→1001→1000 (When set to 1000, it is STATUS4 PORT OVF = 1)→…→1→0

◆ The initial count of each counter can be set to H'8000_0000.
However, if H'8000_0000 is set, OVF=1 of each counter at the STATUS4 PORT is assumed.

◆ If the maximum count of the address counter is set to other than H'FFFF_FFFF, the following restriction is imposed.
・A general-purpose command with the absolute address specified is invalid.
・The SOFT LIMIT function is invalid.

9. Other Specifications

9-1. Timing

- An expression "Command writing" with a $\overline{WR}$ signal to be explained later indicates that the C-V870 responded to the writing of the last byte of a command.

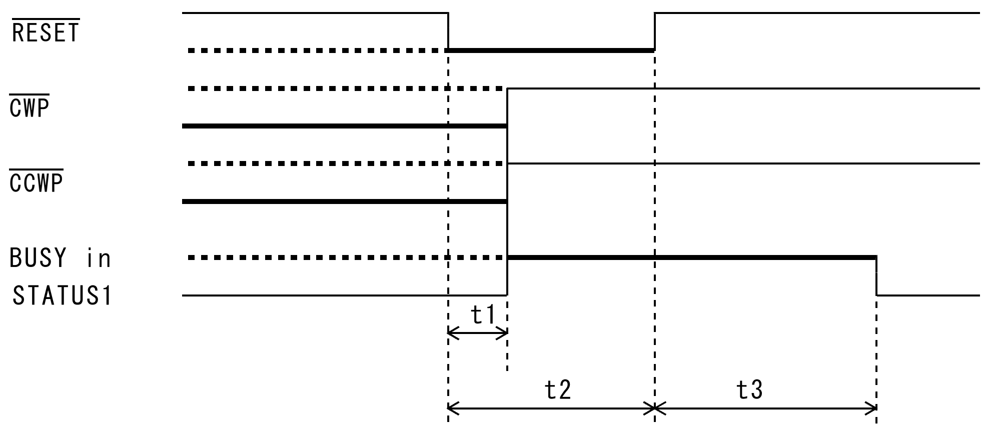
- Each drive time
  The following explanation is common to each axis. The first characters X, Y, Z, and A of each name are omitted.
  MCC06 serially executes the processing of the X/Y and Z/A axes with priority orders assigned.
  Priority order: In-drive processing > drive stop processing > drive start processing > set parameter processing
  - When both axes are in set parameter processing, processing is executed in the order that it is generated.
  - If drive start processing is generated for the other axis while own axis is in set parameter processing, the drive start processing of that axis is given priority.

*1 T2 of drive start processing is affected by the processing time of the other axis.
- When the other axis is at DRIVE=1, the in-drive processing (per speed change cycle) of the other axis is given priority.
  The in-drive processing time of the other axis is 80 μs (160 μs) at a constant speed and 160 μs at maximum speed.
- If t3 processing is generated for the other axis, the t3 processing of the other axis is given priority.

*2 T3 of drive stop processing is affected by the processing time of the other axis.
- When the other axis is at DRIVE=1, the in-drive processing (per speed change cycle) of the other axis is given priority.
  The in-drive processing time of the other axis is 80 μs (160 μs) at a constant speed and 160 μs at maximum speed.

*3 T5 and T6 of servo response are affected by the processing time of the other axis.
- When the other axis is at DRIVE=1, the in-drive processing (per speed change cycle) of the other axis is given priority.
  The in-drive processing time of the other axis is 80 μs (160 μs) at a constant speed and 160 μs at maximum speed.
- If t2 processing is generated for the other axis, the t2 processing of the other axis is given priority.
- If t3 processing is generated for the other axis, the t3 processing of the other axis is given priority.

(1) Reset



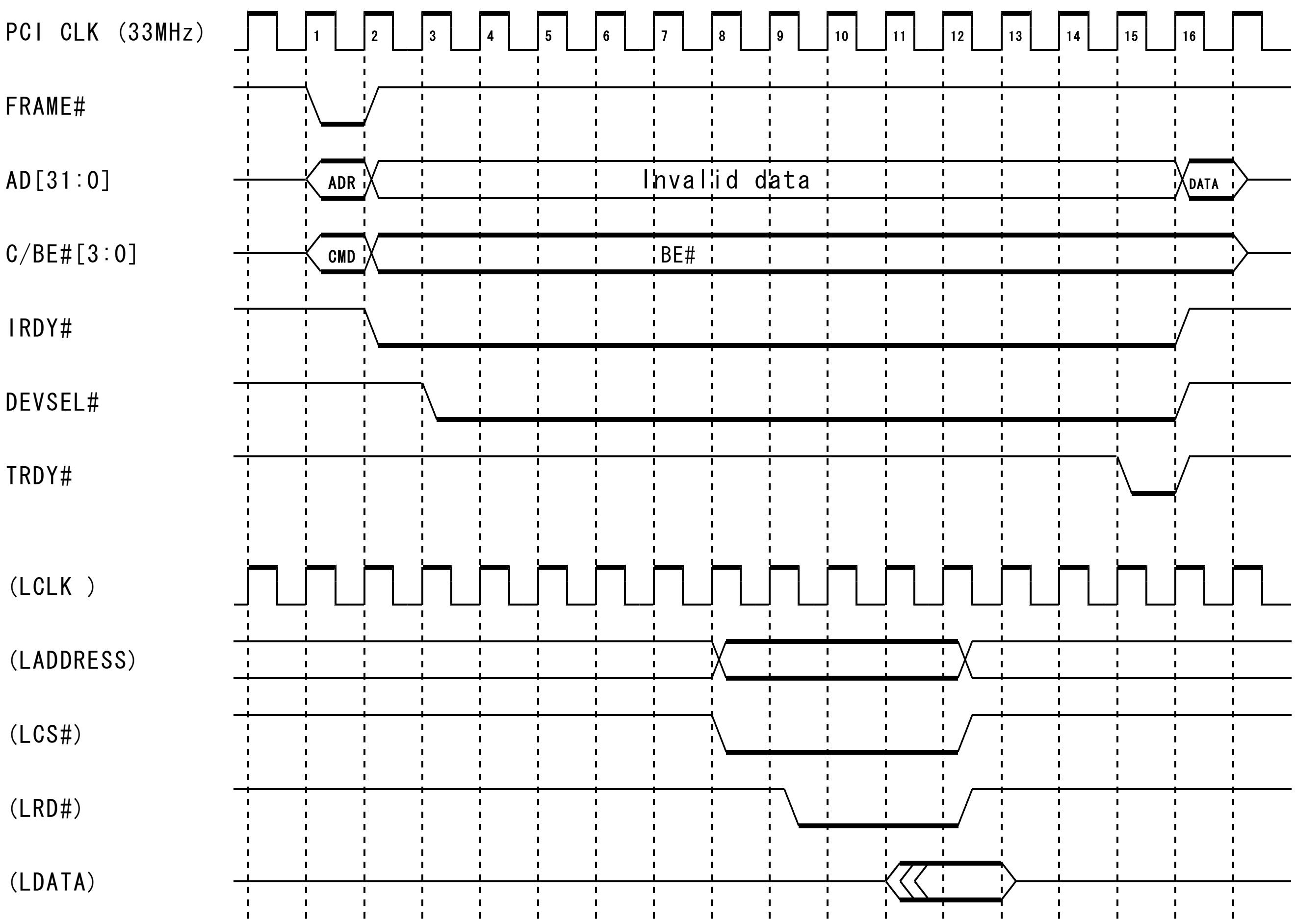
t1 < 5ms (Note 10μs)
t2 ≧ 5ms (Note 1.0ms)
t3 < 5ms (Note 50μs)

(Note) For system reset on PCI BUS side

(2) PCI bus

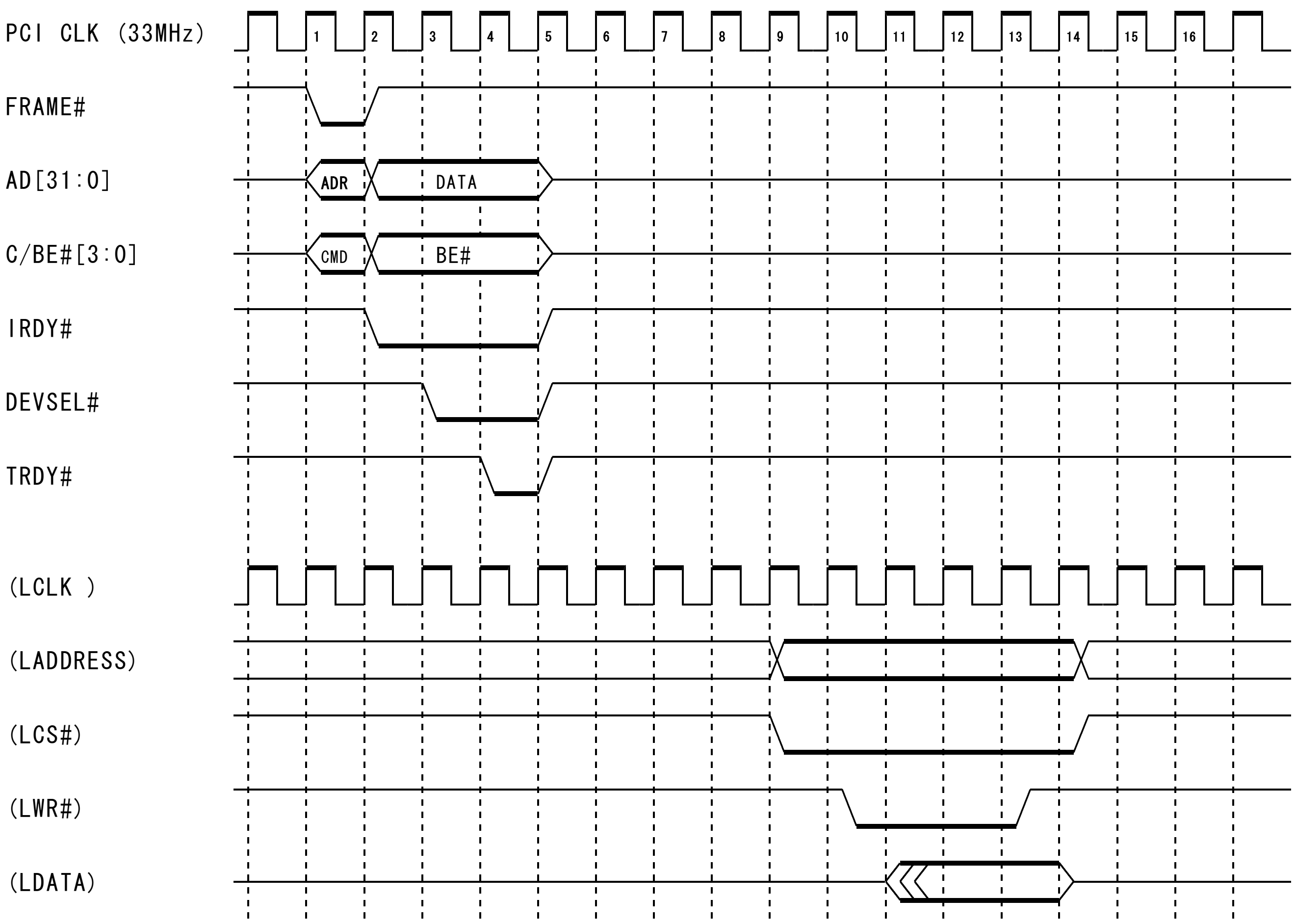
■READ

Parentheses contain internal timings.

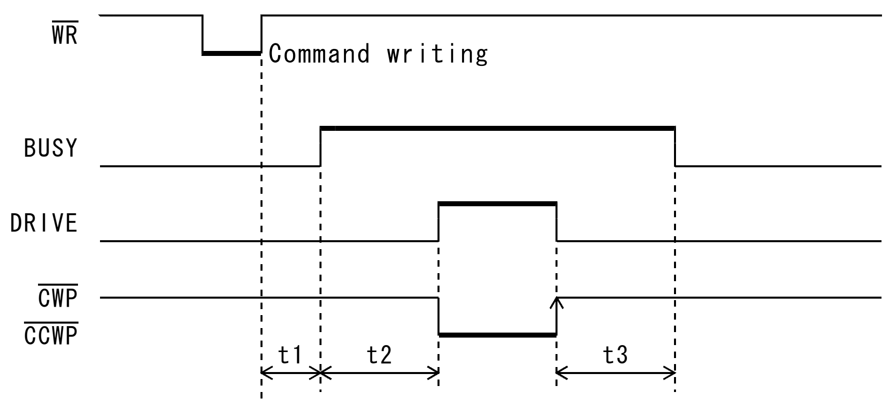


■WRITE

Parentheses contain internal timings.



(3) JOG drive



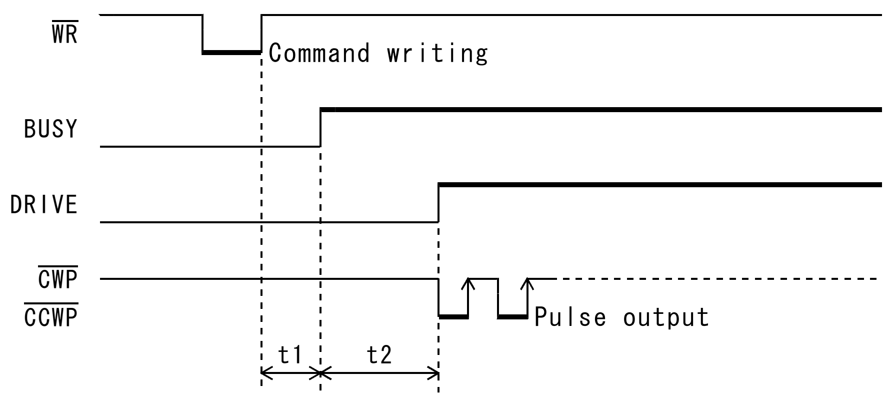
t1＜200 ns

t2＜146 μs *1

t3＜77 μs *2

T2 and T3 are affected by the processing time of the other axis.

(4) SCAN drive

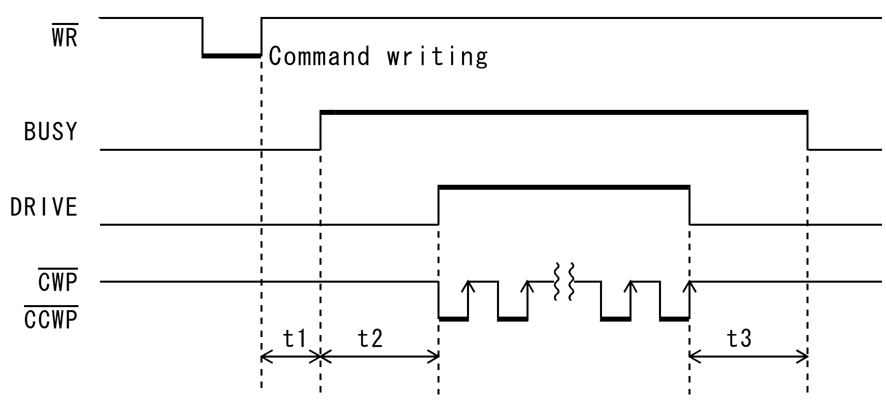


t1＜200 ns

Linear acceleration/deceleration
t2＜146 μs *1
S-curve acceleration/deceleration
t2＜151 μs *1

T2 is affected by the processing time of the other axis.

(5) INDEX drive



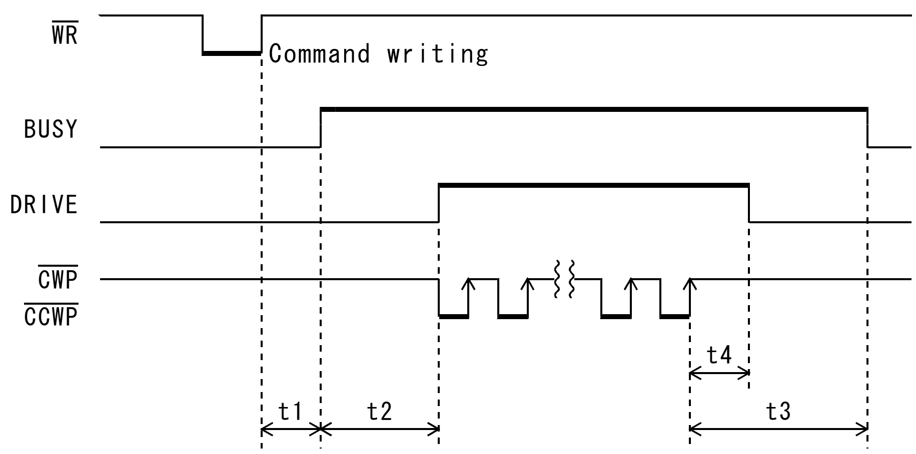
t1＜200 ns

Linear acceleration/deceleration
t2＜166 μs *1
S-curve acceleration/deceleration
t2＜171 μs *1

t3＜77 μs *2

T2 and T3 are affected by the processing time of the other axis.

(6) Interpolation drive



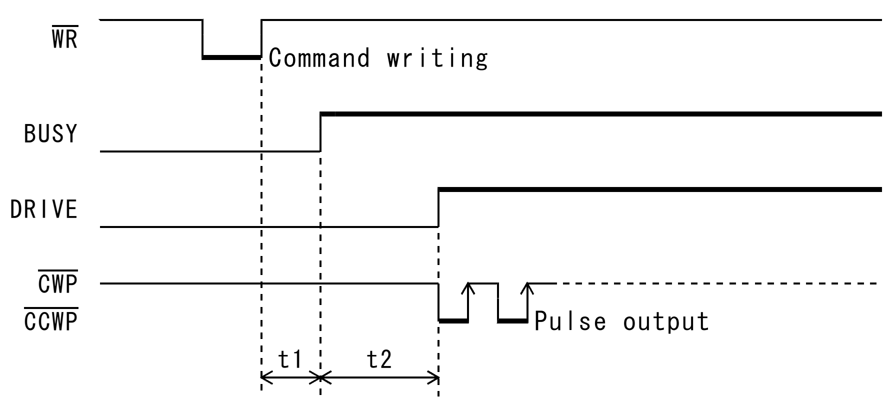
t1＜200 ns

t3＜77 μs

t4＜4 μs

・Absolute address 2-axis linear interpolation drive	: T2 of linear acceleration /deceleration <350 μs	T2 of S-curve acceleration/ deceleration <355 μs
・Relative address 2-axis linear interpolation drive	: T2 of linear acceleration /deceleration <300 μs	T2 of S-curve acceleration/ deceleration <305 μs
・Absolute address center-point circular interpolation drive	: T2 of linear acceleration /deceleration <630 μs	T2 of S-curve acceleration/ deceleration <635 μs
・Absolute address passing-point circular interpolation drive	: T2 of linear acceleration /deceleration <785 μs	T2 of S-curve acceleration/ deceleration <790 μs
・Relative address center-point circular interpolation drive	: T2 of linear acceleration /deceleration <620 μs	T2 of S-curve acceleration/ deceleration <625 μs
・Relative address passing-point circular interpolation drive	: T2 of linear acceleration /deceleration <772 μs	T2 of S-curve acceleration/ deceleration <777 μs

(7) ORIGIN drive

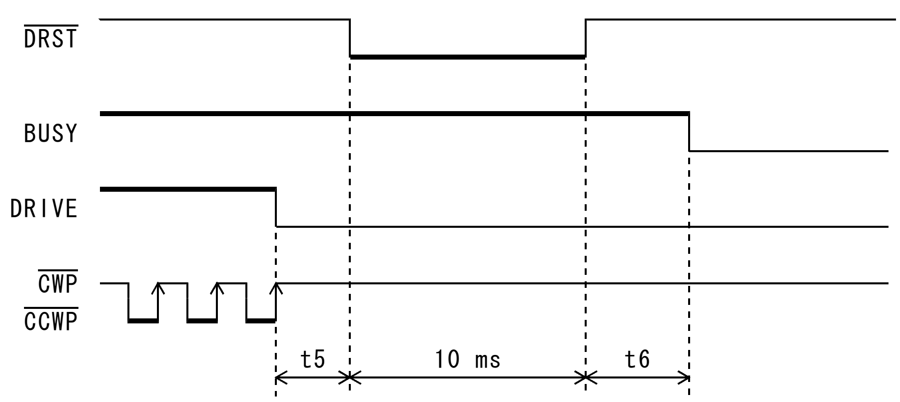


t1＜200 ns

Linear acceleration/deceleration
t2＜168 μs ＊1
S-curve acceleration/deceleration
t2＜173 μs ＊1

T2 is affected by the processing time of the other axis.

(8) AUTO DRST output by ORIGIN drive (servo response)



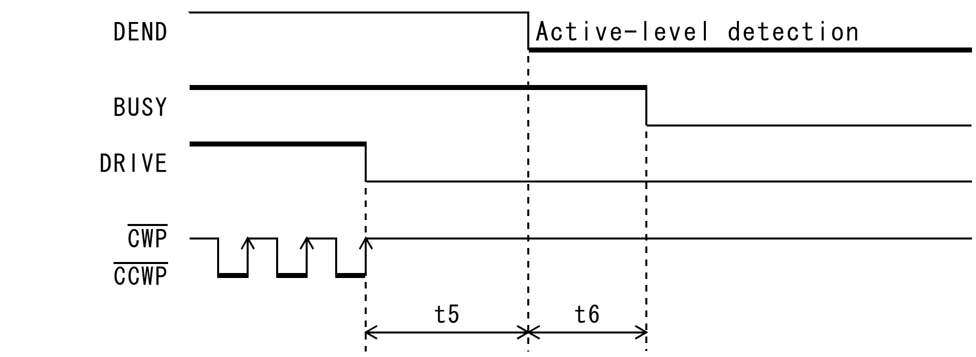
t6＜115 μs ＊3

T5 and T6 are affected by the processing time of the other axis.

◆ T5 depends on the ORG model numbers.
 ・ORG-0/1/10/11 : t5＜115 μs ＊3 (not affected by t2 of the other axis)
 ・ORG-2/3/4/5/12 : t5≒JOG DELAY TIME ＊3

◆ Until the DRST signal is output, about 100μs is added because of a delay of a signal isolation circuit.

(9) Active-level detection of DEND signal (servo response)



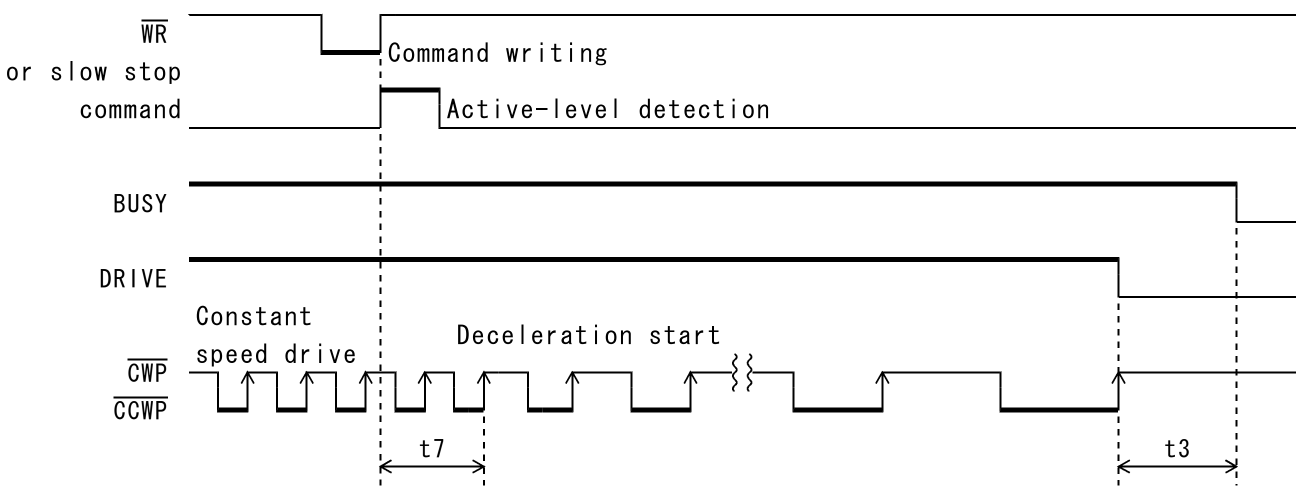
t6< 115 μs *3

T5 and T6 are affected by the processing time of the other axis.

◆ T5 depends on servo driver characteristics. (*3)

◆ Until the DEND signal is detected, a delay of about 300μs is added by an internal CR filter.

(10) Slow stop and LIMIT slow stop

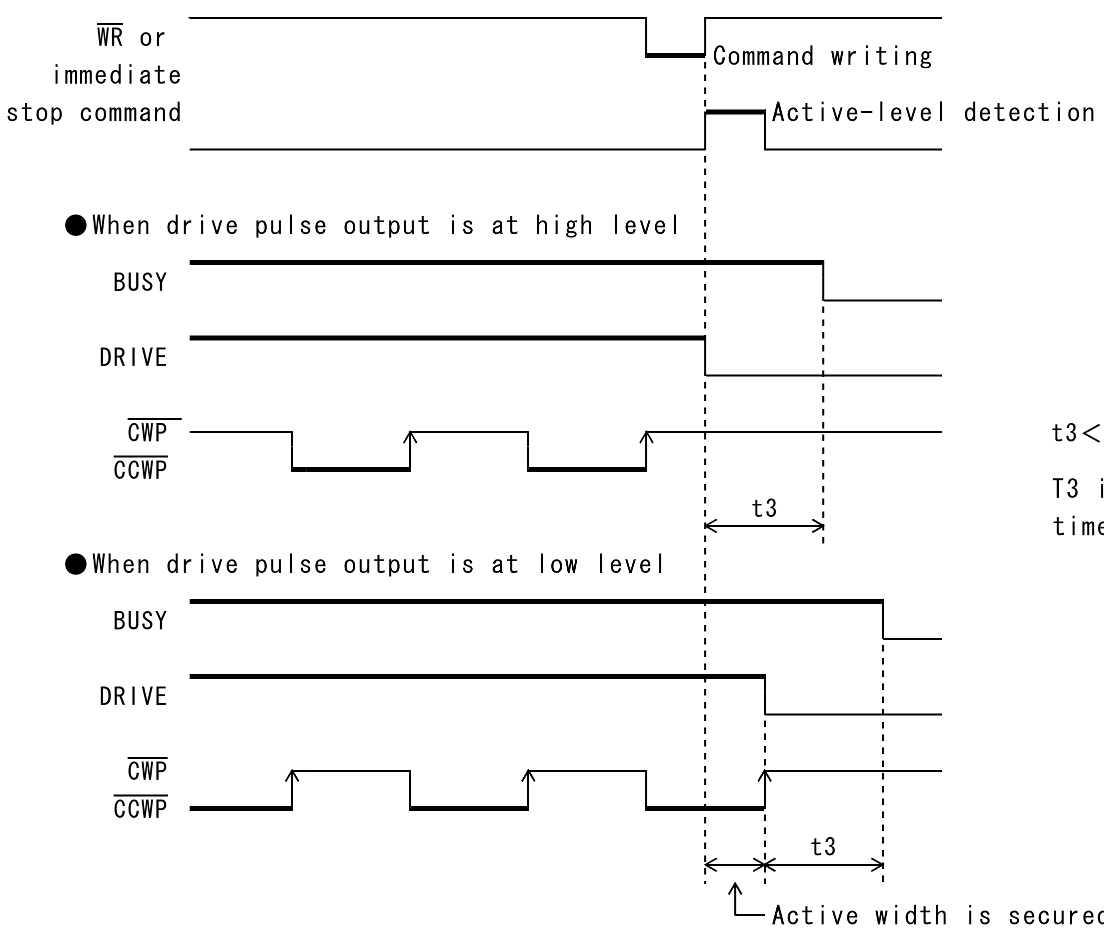


640 μs< t7< 640 μs + 1 cycle of drive pulse at slow stop detection time

t3< 72 μs *2 T3 is affected by the processing time of the other axis.

◆ Until the LIMIT signal is detected, a delay of about 300μs is added by an internal CR filter.

(11) Immediate stop and LIMIT immediate stop

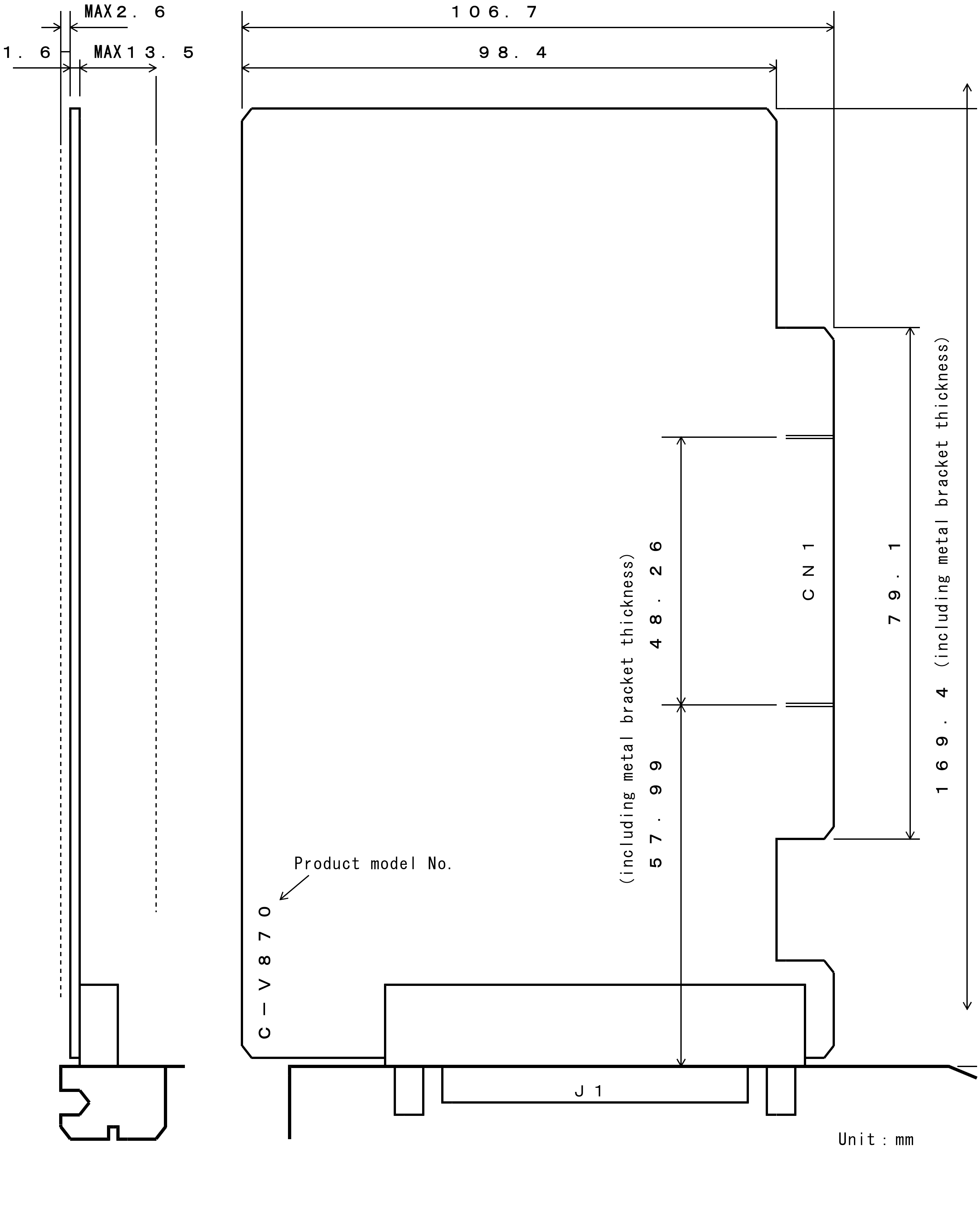


t3< 62 μs *2

T3 is affected by the processing time of the other axis.

◆ Until the LIMIT signal is detected, a delay of about 300μs is added by an internal CR filter.

9-2. Outside Dimensions



10. Maintenance

> ⚠ CAUTION
>
> Incorrect handling may lead to an electric shock.
> Inspection and maintenance need to be conducted by an expert engineer only.
> Before inspecting and maintaining this product, turn off the power.

> ⚠ CAUTION
>
> An electric shock, injuries, and fire may be caused.
> Do not make repair and modification such as product disassembly and parts replacement.

10-1. Maintenance and Inspection

(1) Cleaning method

To use the product in a favorable condition, conduct cycleic cleaning as follows.

- During the cleaning of the terminal plating part, wipe it with a dry, soft cloth.
- If stain is not removed by the dry wiping, soak a cloth in a solution in which neutral detergent is diluted, wring it out, and wipe off the stain with it.
- Do not use a high-volatile solvent such as benzene and thinner, and a wipe. This may deteriorate gold plating by transformation and oxidation.

(2) Inspection method

To use the product in a favorable condition, conduct periodic inspection.
Usually conduct the inspection every six months or every year.
To use the product in an extremely hot and humid or dusty environment, shorten the inspection interval.

Inspection item	Inspection details	Criteria	Inspection method
Environment state	Check whether ambient and intra-device temperatures are appropriate.	0～+ 40℃	Thermometer
	Check whether ambient and intra-device humidifies are appropriate.	10%～80%RH(without dew condensation)	Hygrometer
	Check whether dust is deposited.	No dust	Visual check
Installation state	Check whether the product is firmly secured.	Not loose(6kg·cm)	Torque wrench
	Check whether connectors are completely inserted.	Not loose and removed	Visual check
	Check whether cables are to be removed.	Not loose and removed	Visual check
	Check whether connecting cables are to be broken.	Appearance is normal.	Visual check

(3) Replacement method

If the product becomes faulty, repair it immediately because the entire device system may be affec ted.
To make the repair smoothly, a spare product should be prepared.

- To prevent an accident such as an electric shock during replacement, stop the device and turn off the power.
- If poor contacting is assumed, wipe contacts with a clean cotton cloth that is wet with industrial alcohol.
- Take a record of switch settings during replacement and return them to their state before the replacement.
- After the replacement, confirm that the new product is normal.
- For the faulty product replaced, have it repaired by returning it to the company with a report indicating as much details on the failure as possible.

10-2. Saving and Disposal

(1) Saving method

Save the product in the following environment.

- Indoor (place in which the product is not in the path of direct sunlight)
- Place at ambient temperature and humidity within the specifications
- Place free of corrosive and inflammable gases
- Place free of dust, dirt, salt, and iron powder
- Place free of direct vibration and shock to the product body
- Place free of water, oil, and chemicals droplets
- Place where a person cannot ride or put objects on the product

(2) Disposal method

Handle the product as industrial waste.

10-3. Trouble-shooting

No.	Symptom	Check item
1	Although access may be normally made, pulse output is not made even by entering a pulse output command. At this point, both DRIVE and BUSY bits in STATUS are 0.	・Aren't you using an index drive with no output pulse? (The specified absolute address is the current location.) ・Check the ERROR, LSEND, and FSEND bits in STATUS1.
2	Although access may be normally made, pulse output is not made even by entering a pulse output command. At this point, both DRIVE and BUSY bits in STATUS are 1.	・Is the DEND signal specific to NOT ACTIVE in the servo specification.
3	Pulse output is started but not stopped.	・Aren't you using SCAN, ORIGIN DRIVE? ・INDEX DRIVE If INCREMENTAL is specified, the specified number of pulses may be too great. If ABSOLUTE is specified, the set address may be too far. In these cases, the pulse output stops sooner or later.
4	Although the pulse output has stopped, the BUSY bit in STATUS is not set to 0 forever.	・Isn't the DEND signal returned with a servo motor set? If the DEND signal goes ON, the BUSY bit in STATUS1 is set to 0. The DEND TIME SET command can be used to make error judgment by the time.
5	Machine origin detection (ORG DRIVE) cannot normally be made or is not completed forever.	・Is the sensor logic (ON/OFF with the light received) correct? ・Are sensor connections (especially the GND line) correct? For models ORG-1 and ORG-3, is an edge made in the CCWLM area because the sun visor is too long? ・Because ORG-2,3,4,5 is affected by mechanical vibration, care must be taken. If there is a vibration, use ORG-0/1 or extend a delay with the ORIGIN DELAY SET COMMAND or set a margin pulse. ・When a servo motor is set, check each process for a DEND signal. If DEND does not return, the servo motor stops at an intermediate process. ・When ORG-3 or ORG-5 is selected to complete the ORG DRIVE within the ORG sensor, the ORG DRIVE moves in the sensor area only by one pulse from the sensor edge when it is completed. Therefore, the sensor may switch off with a slight mechanical vibration. In this case, move the ORG DRIVE in the sensor area by setting INDEX DRIVE to several pulses in the + (CW) direction after it is completed.
6	When the counter value of the pulse counter is read, it may sometimes go wrong.	・Are you reading the counter value from the upper bytes (2^{31} to 2^{16}) to the lower bytes (2^{15} to 2^{0})? The counter value of each counter may go wrong unless it is read from the upper bytes. ・For optimization, some compilers do not compile in a source list order. In this case, perform the compilation, canceling the optimization.

No.	Symptom	Check item
7	When speed data is read, it sometimes may go wrong.	・Are you reading the data from the upper bytes (2^{31} to 2^{16}) to the lower bytes (2^{15} to 2^{0})? The speed data may go wrong unless it is read from the upper bytes.
8	The STATUS bit may be generated at a counter value that differs from the set value.	・Is there a COMPARE register without data being set? And, is the counter value of each counter overflowing? Since each COMPARE register is reset to an overflow value, if there is a COMPARE register without data being set, a STATUS signal is generated by the overflow value. Inhibit COMP INT of an unused COMPARE register with each COUNTER INITIALIZE COMMAND.
9	An output pulse speed may differ from the set value.	・When a high speed is set, the set value may differ from the actual value.
10	An acceleration/deceleration time constant may differ from the URATE and DRATE set values.	・Doesn't the specified data differ from the selected rate type? Data at rate setting time depends on a rate type that is selected by SPEC INITIALIZE1. ・When the rate type is the calculation mode, did you set resolution data? When the calculation mode is used, the resolution data needs to be set in addition to the rate data.
11	A set HSPD is not reached.	・In the case of index drive, isn't a triangular drive taken because the number of indexes is too small?
12	An LSPD is output for too long a time.	・In the case of INDEX and SRATE INDEX, isn't END PULSE set?
13	Drive is not taken up to the specified number of pulses.	・Isn't a soft limit valid?
14	Speed is slow near a soft limit.	・The soft limit is used to start deceleration from a set value in order not to exceed the set value.
15	When an asymmetrical S-RATE DRIVE function is enabled, the S-RATE INDEX DRIVE cannot be started. At this point, the ERROR bit in STATUS1 is 1.	・Are you executing the SRATE DOWN POINT SET COMMAND before drive? When the asymmetrical S-RATE DRIVE function is enabled, the SRATE DOWN POINT SET COMMAND needs to be executed to start the SRATE INDEX DRIVE with the DRIVE parameter changed.
16	If a triangular drive preventive function is used, the drive time may be longer than not using that function.	・When the top speed part is rounded by the triangular drive preventive function, the drive time is extended because the top speed goes lower than not using that function. However, even if the triangular drive preventive function is enabled and if the drive reaches the SHSPD, the drive time remains unchanged.
17	Vibration is great between continuous operation intervals.	・Are you using the END PULSE DRIVE function? Or, are you using correction drive, that is, interpolation drive? In this case, stabilize the intervals by setting the drive delay time.

11. Appendix

11-1. Initial Specification Table

These are post-reset initial specifications. When the specifications need to be changed, change them using the corresponding commands.

Data name or specification	Initial specification	Corresponding command
Motor type	Stepping motor (open loop)	HENSA INITIALIZE1
Motor resolution upon detection of step-out	10,000 divisions	HENSA INITIALIZE2
Encoder resolution upon detection of step-out	500 divisions	HENSA INITIALIZE3
Detection value 1 upon detection of step-out	3.6°	HENSA INITIALIZE4
Detection value 2 upon detection of step-out	7.2°	
Rotating speed set value 1 upon detection of step-out	1.0rps	HENSA INITIALIZE5
Rotating speed set value 2 upon detection of step-out	0.8rps	HENSA INITIALIZE6
SIGNAL OUTA TYPE	CNTINT	HARD INITIALIZE1
SIGNAL OUTB TYPE	DFLINT	
OUT0 TYPE	ADRINT	
SIGNAL OUT0 output selection signal	X axis SIGNAL OUTA(CNTINT)	HARD CONFIGURATION1
SIGNAL OUT1 output selection signal	Y axis SIGNAL OUTA(CNTINT)	
SIGNAL OUT2 output selection signal	X axis SIGNAL OUTB(DFLINT)	
SIGNAL OUT3 output selection signal	Y axis SIGNAL OUTB(DFLINT)	
Each output method of SIGNAL OUT3-0 signal	Through-outputs a selected signal as it is.	HARD CONFIGURATION2
Each output time of SIGNAL OUT3-0 signal	1μs one-shot output	HARD CONFIGURATION3
SIGNAL IN0 signal function	Function not assigned	HARD CONFIGURATION4
SIGNAL IN1 signal function	Function not assigned	
SIGNAL IN2 signal function	Function not assigned	
SIGNAL IN3 signal function	Function not assigned	
SENSOR0 signal function	Connects to Z axis SS0 signal	
SENSOR1 signal function	Connects to A axis SS0 signal	
General-purpose I/O batch processing function	Operates general-purpose I/O signal with MCC06 of each axis.	HARD CONFIGURATION5
Pulse output system	Output in independent direction	SPEC INITIALIZE1
First pulse width	Specific to 100μs	
RATE TYPE	L1-TYPE	
RESOLUTION data	RESOL=1	
CWLM signal input function	Immediate stop by + direction LIMIT	SPEC INITIALIZE2
CCWLM signal input function	Immediate stop by - direction LIMIT	
SS0 signal input function	SS0 signal for SENSOR drive	
SS1 signal input function	SS1 signal for SENSOR drive	
RDYIN output specification	H at STATUS1 PORT DRVEND=1 leading edge	
LSPD	300Hz/800Hz(by JP1)	LSPD SET
HSPD	3000Hz/10,000Hz(by JP1)	HSPD SET
URATE(RATE DATA TABLE No.)	No.H'18(100ms/1kHz)/H'25(30ms/1kHz)(by JP1)	RATE SET
DRATE(RATE DATA TABLE No.)	No.H'18(100ms/1kHz)/H'25(30ms/1kHz)(by JP1)	
END PULSE count	0 pulse	END PULSE SET
ESPD	300Hz/800Hz(by JP1)	ESPD SET
ESPD DELAY	0μs	ESPD DELAY SET
SLSPD	300Hz/800Hz(by JP1)	SLSPD SET
SHSPD	3000Hz/10,000Hz(by JP1)	SHSPD SET
SURATE(RATE DATA TABLE No.)	No.H'18(100ms/1kHz)/H'25(30ms/1kHz)(by JP1)	SRATE SET
SDRATE(RATE DATA TABLE No.)	No.H'18(100ms/1kHz)/H'25(30ms/1kHz)(by JP1)	
SCAREA1	H'0014(1,000msHz)/H'003C(3,000Hz)(by JP1)	SCAREA12 SET
SCAREA2	H'0014(1,000msHz)/H'003C(3,000Hz)(by JP1)	
SCAREA3	H'0014(1,000msHz)/H'003C(3,000Hz)(by JP1)	SCAREA34 SET
SCAREA4	H'0014(1,000msHz)/H'003C(3,000Hz)(by JP1)	
Number of SEND PULSES	0 pulse	SEND PULSE SET
SESPD	300Hz/800Hz(by JP1)	SESPD SET
SESPD DELAY	0μs	SESPD DELAY SET
ORIGIN STRAT DIRECTION	Starts in - (CCW) direction	ORIGIN SPEC SET
JOG SENSOR TYPE	Ends when detecting a machine origin signal edge.	
SENSOR ERROR TYPE	ORIGIN ends with STATUS1 PORT ERROR=1.	
ORIGIN FLG ENABLE	Does not enable drive to near the machine origin	
ERROR PULSE ENABLE	ERROR PULSE detection function invalid	
AUTO DRST ENABLE	Does not output DRST signal when origin detection is completed	
LIMIT END ENABLE	ORIGIN drive does not end at LIMIT stop.	
ORG TYPE	OR (logical addition) of ORG and Z phase (PO signal)	
NORG TYPE	NORG	
ORG DETECT TYPE	ORG composite signal (logical OR of ORG and Z phase (PO signal))	

Data name or specification	Initial specification	Corresponding command
ORG CSPD	300Hz/800Hz(by JP1)	ORG CSPD SET
MARGIN pulse	5 pulse	ORG DELAY SET
LIMIT DELAY	300ms	
SCAN DELAY	50ms	
JOG DELAY	20ms	
ORG OFFSET PULSE	100 pulse	ORG OFFSET PULSE SET
ORG CSCAN ERROR	H'FFFF_FFFF pulse	ORG CSCAN ERROR PULSE SET
ORG JOG ERROR	H'FFFF_FFFF pulse	ORG JOG ERROR PULSE SET
ORG PRESET PULSE	H'0000_0000 pulse	ORG PRESET PULSE SET
INTA# interrupt output	Interrupt not output	INT FACTOR MASK
Counter interrupt output	Interrupt not output	COUNTER COMP MASK
DRST TYPE	General-purpose output	SERVO SPEC SET
DEND TYPE	General-purpose input	
DALM TYPE	General-purpose input	
DEND TIME	327,675ms	DNED TIME SET
COUNTER count pulse	Counts by the output pulses of own axis.	COUNTER INITIALIZE1
	DFL counts the output pulses of own axis and EA/EB.	
	SPEED measures and counts EA/EB.	
COUNT TYPE	Counts EA and EB, the multiplier is 1.	
INT TYPE	Outputs a match signal, level-latching it.	
INT PULSE TYPE	Output width at through-output time: 200 ns	
COMP GATE TYPE	OR-outputs all of COMPs 1, 2, and 3.	
COMP STOP TYPE	Immediately stops COMPs 1, 2, and 3 by match output.	
COMP DETECT TYPE	Compares counter values, converting them to absolute values.	*DFL counter only
COMP1 INT ENABLE	COMP1 match output is not INT-output.	
COMP1 STOP ENABLE	Does not execute the COMP1 match output immediate stop function.	
AUTO CLEAR ENABLE	Does not clear a counter by COMP1 match output.	*Excluding address counter
RELOAD ENABLE	Does not set data again by COMP1 match output.	
COMP2,3 INT ENABLE	Does not INT-output a COMP2/3 match signal.	COUNTER INITIALIZE2
COMP2,3 STOP ENABLE	Does not execute the COMP2/3 match output immediate stop function.	
COMP2,3 TYPE	Output ADDRESS, PULSE, and SPEED counters in =	
	DFL counter COMP2: ≧ 、COMP3: ≦	
DIVISION	Count pulse divide count: 1 (not divided)	COUNTER INITIALIZE3
EXT PULSE TYPE	1μs	*Address counter only
COUNT PULSE SEL2	DFL counter:Used as differential counter	
	SPEED counter:Measures and counts pulses by one cycle.	
COUNT ENABLE TYPE	Does not make measurement.	*SPEED counter only
COMP2,3 TYPE	Compares with an in-measurement counter value.	*SPEED counter only
LATCH TYPE	Latch by each LATCH DATA PORT SELECT	COUNTER LATCH SPEC SET
COUNTER SELECT PORT	PULSE COUNTER	Each PORT SELECT
ADDRESSCOUNTER value	H'0000_0000	ADDRESS COUNTER PRESET
PULSE COUNTER value	H'0000_0000	PULSE COUNTER PRESET
PULSE DIFFERENTIAL COUNTER値	H'0000_0000	DFL COUNTER PRESET
SPEED COUNTER value	H'0000_0000	—
SPEED COUNTER COMPARE REGISTER1/2/3	H'FFFF_FFFF	COUNTER COMPARE REGISTER SET
Other COUNTER COMPARE REGISTER1/2/3	H'8000_0000	COUNTER COMPARE REGISTER SET
Each COUNTER MAX (OVF) COUNT SET	H'FFFF_FFFF	Each COUNTER MAX (OVF) COUNT SET

【RATE DATA initial specifications in calculation mode】

Data name or specification	Initial specification	Corresponding command
RATE DATA	H'186A / H'0753 (by JP1)	RATE DATA SET
SRATE DATA	H'186A / H'0753 (by JP1)	SRATE DATA SET

11-2. All Commands

The commands prepared for the C-V870 are configured as follows.

- General-purpose commands
  BUSY=0 in the MCC06 STATUS1 PORT or H.RDY=1 in the HENSA STATUS1 PORT needs to be checked before these commands are written.
  - MCC06 general-purpose DRIVE COMMAND
  - MCC06 general-purpose COUNTER COMMAND
  - HENSA general-purpose COMMAND

- Special commands
  These commands can be executed at all times.
  - MCC06 special DRIVE COMMAND
  - MCC06 special COUNTER COMMAND
  - HENSA special COMMAND
  - HARD CONFIG COMMAND

(1) MCC06 general-purpose DRIVE COMMAND

●is a command that involves a pulse input.

HEX CODE	COMMAND NAME	Explanation	Standard function	Applied function
0000	NO OPERATION	No function	○	
0001	SPEC INITIALIZE1	Sets a pulse output specification and rate extent.	○	○
0002	SPEC INITIALIZE2	Sets the LIMIT, SS0, and SS1 functions and the RDYINT specifications.	○	
0003	SPEC INITIALIZE3	Sets an applied drive function.		○
0007	DRIVE DELAY SET	Sets a delay time at continuous and reverse drive time	○	
0008	CW SOFT LIMIT SET	Sets a CW-direction soft limit address.		○
0009	CCW SOFT LIMIT SET	Sets a CCW-direction soft limit address.		○
0010	LSPD SET	Sets the starting/ending speed of linear acceleration/deceleration.	○	
0011	HSPD SET	Sets the maximum speed of linear acceleration/deceleration.	○	
0012	ELSPD SET	Sets the ending speed of linear acceleration/deceleration.		○
0013	RATE SET	Sets the time constant of linear acceleration/deceleration.	○	
0018	END PULSE SET	Sets a linear acceleration/deceleration END PULSE count.	○	
0019	ESPD SET	Sets a linear acceleration/deceleration END PULSE speed.	○	
001A	ESPD DELAY SET	Sets the time until a linear acceleration/deceleration END PULSE starts.	○	
001E	RATE DATA SET	Sets speed change cycle data for a linear acceleration/deceleration drive.		○
001F	DOWN POINT SET	Executes the parameter processing of applied linear acceleration/deceleration.		○
0020	+JOG	One pulse drive in + (CW) direction	●	
0021	-JOG	One pulse drive in - (CCW) direction	●	
0022	+SCAN	Linear acceleration/deceleration continuous drive in + (CW) direction	●	
0023	-SCAN	Linear acceleration/deceleration continuous drive in - (CCW) direction	●	
0024	INC INDEX	Linear acceleration/deceleration positioning drive up to specified relative address	●	
0025	ABS INDEX	Linear acceleration/deceleration positioning drive up to specified absolute address	●	
0030	SLSPD SET	Sets an S-curve acceleration/deceleration starting/ending speed.	○	
0031	SHSPD SET	Sets an S-curve acceleration/deceleration maximum speed.	○	
0032	SELSPD SET	Sets an S-curve acceleration/deceleration ending speed.		○
0033	SRATE SET	Sets the time constant of S-curve acceleration/deceleration.	○	
0034	SCAREA12 SET	Sets speed area 12 for an S-curve acceleration/deceleration curve.	○	
0035	SCAREA34 SET	Sets speed area 34 for an S-curve acceleration/deceleration curve.	○	
0038	SEND PULSE SET	Sets an S-curve acceleration/deceleration END PULSE count.	○	
0039	SESPD SET	Sets an S-curve acceleration/deceleration END PULSE speed.	○	
003A	SESPD DELAY SET	Set the time until an S-curve acceleration/deceleration END PULSE starts.	○	
003E	SRATE DATA SET	Sets speed change cycle data for an S-curve acceleration/deceleration drive.		○
003F	SRATE DOWN POINT SET	Executes the parameter processing of applied S-curve acceleration/deceleration.		○
0042	+ SRATE SCAN	S-curve acceleration/deceleration continuous drive in + (CW) direction	●	
0043	- SRATE SCAN	S-curve acceleration/deceleration continuous drive in - (CCW) direction	●	
0044	INC SRATE INDEX	S-curve acceleration/deceleration positioning drive up to specified relative address	●	
0045	ABS SRATE INDEX	S-curve acceleration/deceleration positioning drive up to specified absolute address	●	

HEX CODE	COMMAND NAME	Explanation	Standard function	Applied function
0060	ORIGIN SPEC SET	Sets ORIGIN drive operation specifications.	○	
0061	ORIGIN CSPD SET	Sets a CONSTANT SCAN process pulse speed.	○	
0062	ORIGIN DELAY SET	Sets a drive inter-process delay and MARGIN pulse count.	○	
0063	ORIGIN OFFSET PULSE SET	Sets an OFFSET pulse count in an address near the machine origin.	○	
0064	ORIGIN CSCAN ERROR PULSE SET	Sets an error detection pulse count at CONSTANT SCAN process time.	○	
0065	ORIGIN JOG ERROR PULSE SET	Sets an error detection pulse count at JOG process time.	○	
0068	ORIGIN PRESET PULSE SET	Sets a PRESET ORIGIN PRESET pulse count.	○	
0070	ORIGIN	Linear acceleration/deceleration ORIGIN drive	●	
0071	SRATE ORIGIN	S-curve acceleration/deceleration ORIGIN drive	●	
0074	PRESET ORIGIN	Linear acceleration/deceleration PRESET ORIGIN drive	●	
0075	SRATE PRESET ORIGIN	S-curve acceleration/deceleration PRESET ORIGIN drive	●	
0080	STBY SPEC SET	Sets a STBY cancel condition.	○	
0082	SERVO SPEC SET	Sets a DRST, DEND, and DALM serve response.	○	
0083	DEND TIME SET	Sets a DEND error judgment time.	○	
0088	ERROR STATUS READ	Reads an error.	○	
0089	SET DATA READ	Reads set data and parameters.	○	
0090	+SENSOR SCAN1	Linear acceleration/deceleration SENSOR SCAN1 drive in + (CW) direction		●
0091	-SENSOR SCAN1	Linear acceleration/deceleration SENSOR SCAN1 drive in - (CCW) direction		●
0094	SENSOR INDEX1	Linear acceleration/deceleration SENSOR INDEX1 drive		●
0095	SENSOR INDEX2	Linear acceleration/deceleration SENSOR INDEX2 drive		●
0096	SENSOR INDEX3	Linear acceleration/deceleration SENSOR INDEX3 drive		●
0098	+SRATE SENSOR SCAN1	S-curve acceleration/deceleration SENSOR SCAN1 drive in + (CW) direction		●
0099	-SRATE SENSOR SCAN1	S-curve acceleration/deceleration SENSOR SCAN1 drive in - (CCW) direction		●
009C	SRATE SENSOR INDEX1	S-curve acceleration/deceleration SENSOR INDEX1 drive		●
009D	SRATE SENSOR INDEX2	S-curve acceleration/deceleration SENSOR INDEX2 drive		●
009E	SRATE SENSOR INDEX3	S-curve acceleration/deceleration SENSOR INDEX3 drive		●
00B0	CHANGE POINT SET	Sets a change-point detection function and detection data.		○
00B1	CHANGE DATA SET	Sets a change-point drive change function and change data.		○
00B7	AUTO CHANGE DRIVE SET	Executes AUTO CHANGE drive parameter processing.		○
00B8	+AUTO CHANGE SCAN	Executes the AUTO CHANGE function by starting the + direction SCAN.		●
00B9	-AUTO CHANGE SCAN	Executes the AUTO CHANGE function by starting the - direction SCAN.		●
00BA	AUTO CHANGE INC INDEX	Executes the AUTO CHANGE function by starting the INC INDEX.		●
00BB	AUTO CHANGE ABS INDEX	Executes the AUTO CHANGE function by starting the ABS INDEX.		●
0100	CENTER POSITION SET	Sets circle center coordinates in absolute-address 2-axis circular interpolation.	○	
0101	PASS POSITOIN SET	Sets arc passing-point coordinates in absolute-address 2-axis circular interpolation.	○	
010F	CP SPEC SET	Sets an interpolation drive applied function.		○
0110	ABS STRAIGHT CP	Absolute address 2-axis linear interpolation drive for linear acceleration/deceleration	●	
0111	ABS SRATE STRAIGHT CP	Absolute address 2-axis linear interpolation drive for S-curve acceleration/deceleration	●	
0112	ABS STRAIGHT CONST CP	Absolute address constant linear speed 2-axis linear interpolation drive for linear acceleration/deceleration	●	
0113	ABS SRATE STRAIGHT CONST CP	Absolute address constant linear speed 2-axis linear interpolation drive for S-curve acceleration/deceleration	●	
0120	+ABS CIRCULAR CP	Absolute address CW direction circular interpolation drive for linear acceleration/deceleration	●	
0121	-ABS CIRCULAR CP	Absolute address CCW direction circular interpolation drive for linear acceleration/deceleration	●	
0122	+ABS SRATE CIRCULAR CP	Absolute address CW direction circular interpolation drive for S-curve acceleration/deceleration	●	
0123	-ABS SRATE CIRCULAR CP	Absolute address CCW direction circular interpolation drive for S-curve acceleration/deceleration	●	
0124	+ABS CIRCULAR CONST CP	Absolute address constant linear speed CW direction circular interpolation drive for linear acceleration/deceleration	●	
0125	-ABS CIRCULAR CONST CP	Absolute address constant linear speed CCW direction circular interpolation drive for linear acceleration/deceleration	●	
0126	+ABS SRATE CIRCULAR CONST CP	Absolute address constant linear speed CW direction circular interpolation drive for S-curve acceleration/deceleration	●	
0127	-ABS SRATE CIRCULAR CONST CP	Absolute address constant linear speed CCW direction circular interpolation drive for S-curve acceleration/deceleration	●	
0130	ABS CIRCULAR2 CP	Absolute address passing-point circular interpolation drive for linear acceleration/deceleration	●	
0131	ABS SRATE CIRCULAR2 CP	Absolute address passing-point circular interpolation drive for S-curve acceleration/deceleration	●	
0132	ABS CIRCULAR2 CONST CP	Absolute address constant linear speed passing-point circular interpolation drive for linear acceleration/deceleration	●	

HEX CODE	COMMAND NAME	Explanation	Standard function	Applied function
0133	ABS SRATE CIRCULAR2 CONST CP	Absolute address constant linear speed passing-point circular interpolation drive for S-curve acceleration/deceleration	●	
0138	ABS CIRCULAR3 CP	Absolute address passing-point perfect circle interpolation drive for linear acceleration/deceleration	●	
0139	ABS SRATE CIRCULAR3 CP	Absolute address passing-point perfect circle interpolation drive for S-curve acceleration/deceleration	●	
013A	ABS CIRCULAR3 CONST CP	Absolute address constant linear speed passing-point perfect circle interpolation drive for linear acceleration/deceleration	●	
013B	ABS SRATE CIRCULAR3 CONST CP	Absolute address constant linear speed passing-point perfect circle interpolation drive for S-curve acceleration/deceleration	●	
0150	INC STRAIGHT CP	Relative address 2-axis linear interpolation drive for linear acceleration/deceleration	●	
0151	INC SRATE STRAIGHT CP	Relative address 2-axis linear interpolation drive for S-curve acceleration/deceleration	●	
0152	INC STRAIGHT CONST CP	Relative address constant linear speed 2-axis linear interpolation drive for linear acceleration/deceleration	●	
0153	INC SRATE STRAIGHT CONST CP	Relative address constant linear speed 2-axis linear interpolation drive for S-curve acceleration/deceleration	●	
0160	+INC CIRCULAR CP	Relative address CW direction circular interpolation drive for linear acceleration/deceleration	●	
0161	-INC CIRCULAR CP	Relative address CCW direction circular interpolation drive for linear acceleration/deceleration	●	
0162	+INC SRATE CIRCULAR CP	Relative address CW direction circular interpolation drive for S-curve acceleration/deceleration	●	
0163	-INC SRATE CIRCULAR CP	Relative address CCW direction circular interpolation drive for S-curve acceleration/deceleration	●	
0164	+INC CIRCULAR CONST CP	Relative address constant linear speed CW direction circular interpolation drive for linear acceleration/deceleration	●	
0165	-INC CIRCULAR CONST CP	Relative address constant linear speed CCW direction circular interpolation drive for linear acceleration/deceleration	●	
0166	+INC SRATE CIRCULAR CONST CP	Relative address constant linear speed CW direction circular interpolation drive for S-curve acceleration/deceleration	●	
0167	-INC SRATE CIRCULAR CONST CP	Relative address constant linear speed CCW direction circular interpolation drive for S-curve acceleration/deceleration	●	
0170	INC CIRCULAR2 CP	Relative address passing-point circular interpolation drive for linear acceleration/deceleration	●	
0171	INC SRATE CIRCULAR2 CP	Relative address passing-point circular interpolation drive for S-curve acceleration/deceleration	●	
0172	INC CIRCULAR2 CONST CP	Relative address constant linear speed passing-point circular interpolation drive for linear acceleration/deceleration	●	
0173	INC SRATE CIRCULAR2 CONST CP	Relative address passing-point constant linear speed circular interpolation drive for S-curve acceleration/deceleration	●	
0178	INC CIRCULAR3 CP	Relative address passing-point perfect circle interpolation drive for linear acceleration/deceleration	●	
0179	INC SRATE CIRCULAR3 CP	Relative address passing-point perfect circle interpolation drive for S-curve acceleration/deceleration	●	
017A	INC CIRCULAR3 CONST CP	Relative address constant linear speed passing-point perfect circle interpolation drive for linear acceleration/deceleration	●	
017B	INC SRATE CIRCULAR3 CONST CP	Relative address passing-point constant linear speed perfect circle interpolation drive for S-curve acceleration/deceleration	●	
0190	MULTICHIP STRAIGHT CP	Multi-chip linear interpolation drive for linear acceleration/deceleration		●
0191	MULTICHIP SRATE STRAIGHT CP	Multi-chip linear interpolation drive for S-curve acceleration/deceleration		●
01A0	+MULTICHIP CIRCULAR CP	Optional 2-axis CW circular interpolation drive for linear acceleration/deceleration		●
01A1	-MULTICHIP CIRCULAR CP	Optional 2-axis CCW circular interpolation drive for linear acceleration/deceleration		●
01A2	+MULTICHIP SRATE CIRCULAR CP	Optional 2-axis CW circular interpolation drive for S-curve acceleration/deceleration		●
01A3	-MULTICHIP SRATE CIRCULAR CP	Optional 2-axis CCW circular interpolation drive for S-curve acceleration/deceleration		●
01A4	+MULTICHIP CIRCULAR CONST CP	Optional 2-axis constant linear speed CW circular interpolation drive for linear acceleration/deceleration		●
01A5	-MULTICHIP CIRCULAR CONST CP	Optional 2-axis constant linear speed CCW circular interpolation drive for linear acceleration/deceleration		●
01A6	+MULTICHIP SRATE CIRCULAR CONST CP	Optional 2-axis constant linear speed CW circular interpolation drive for S-curve acceleration/deceleration		●
01A7	-MULTICHIP SRATE CIRCULAR CONST CP	Optional 2-axis constant linear speed CCW circular interpolation drive for S-curve acceleration/deceleration		●

(2) MCC06 special DRIVE COMMAND

HEX CODE	COMMAND NAME	Explanation	Standard function	Applied function
F001	HARD INITIALIZE1	Sets an external output function for OUT0, SIGNAL OUTA and OUTB.	○	
F006	HARD INITIALIZE2	Sets GPIO in using a command reservation function.		○
F006	HARD INITIALIZE6	Sets a digital filter for encoder input.		○
F007	HARD INITIALIZE7	Sets input signal active logic for an axis control part.		○
F00C	SIGNAL OUT	Outputs a general-purpose output signal level set.	○	
F00D	DRST OUT	Outputs an ON signal for 10 ms to DRST.	○	
F00E	SLOW STOP	Executes slow stop.	○	
F00F	FAST STOP	Executes immediate stop.	○	
F010	ADDRESS COUNTER INITIALIZE1	Sets an address counter function (1).	○	
F011	ADDRESS COUNTER INITIALIZE2	Sets an address counter function (2).	○	
F012	ADDRESS COUNTER INITIALIZE3	Sets an address counter function (3).	○	
F014	PULSE COUNTER INITIALIZE1	Sets a pulse counter function (1).	○	
F015	PULSE COUNTER INITIALIZE2	Sets a pulse counter function (2).	○	
F016	PULSE COUNTER INITIALIZE3	Sets a pulse counter function (3).	○	
F018	DFL COUNTER INITIALIZE1	Sets a pulse differential counter function (1).	○	
F019	DFL COUNTER INITIALIZE2	Sets a pulse differential counter function (2).	○	
F01A	DFL COUNTER INITIALIZE3	Sets a pulse differential counter function (3).	○	
F01C	SPEED COUNTER INITIALIZE1	Sets a pulse cycle counter function (1).	○	
F01D	SPEED COUNTER INITIALIZE2	Sets a pulse cycle counter function (2).	○	
F01E	SPEED COUNTER INITIALIZE3	Sets a pulse cycle counter function (3).	○	
F020	INT FACTOR CLR	Separately clears INT2-0 factors that can be output to INTA#.	○	
F021	INT FACTOR MASK	Separately masks INT2-0 factors that can be output to INTA#.	○	
F023	COUNTER COMP MASK	Separately masks counter comparator outputs.	○	
F028	COUNT LATCH SPEC SET	Sets a counter data latch timing and clearance function.	○	
F030	UDC SPEC SET	Sets the change point of the UP/DOWN/CONST CHANGE command.		○
F031	SPEED CHANGE SPEC SET	Sets the change point of the SPEED CHANGE command.		○
F033	INDEX CHANGE SPEC SET	Sets the change point of the INDEX CHANGE command.		○
F034	UP DRIVE	Accelerates an in-execution pulse output speed up to its maximum speed.		○
F035	DOWN DRIVE	Decelerates an in-execution pulse output speed down to its starting speed.		○
F036	CONST DRIVE	Keeps an in-execution pulse output speed at an in-execution speed.		○
F038	SPEED CHANGE	Accelerates/decelerates an in-execution pulse output speed to a specified speed.		○
F03A	RATE CHANGE	Changes an acceleration/deceleration rate being output when the CHANGE function is used.		○
F03C	INC INDEX CHANGE	INDEX with specified data changed from starting point to relative address stop position		○
F03D	ABS INDEX CHANGE	INDEX with specified data changed to absolute address stop position		○
F03E	PLS INDEX CHANGE	INDEX with specified data changed from change point to absolute address stop position		○
F040	MCC SPEED PORT SELECT	Selects READ PORT for a drive pulse speed.	○	
F041	DATA READ PORT SELECT	Selects READ PORT for check data.	○	
F048	ADDRESS COUNTER PORT SELECT	Selects READ PORT for address count data.	○	
F049	PULSE COUNTER PORT SELECT	Selects READ PORT for pulse count data.	○	
F04A	DFL COUNTER PORT SELECT	Selects READ PORT for pulse differential count data.	○	
F04B	SPEED COUNTER PORT SELECT	Selects READ PORT for pulse cycle count data.	○	
F04C	ADDRESS LATCH DATA PORT SELECT	Selects READ PORT for address counter latch data.	○	
F04D	PULSE LATCH DATA PORT SELECT	Selects READ PORT for pulse counter latch data.	○	
F04E	DFL LATCH DATA PORT SELECT	Selects READ PORT for pulse differential counter latch data.	○	
F04F	SPEED LATCH DATA PORT SELECT	Selects READ PORT for pulse cycle counter latch data.	○	

(3) MCC06 general-purpose COUNTER COMMAND

HEX CODE	COMMAND NAME	Explanation	Standard function	Applied function
0000	ADDRESS COUNTER PRESET	MCC06 general-purpose COUNTER COMMAND	○	
000A	ADDRESS COUNTER MAX COUNT SET	Sets the maximum count of the address counter.	○	

(4) MCC06 special COUNTER COMMAND

HEX CODE	COMMAND NAME	Explanation	Standard function	Applied function
0001	ADDRESS COUNTER COMPARE REGISTER1 SET	Sets a detection value in address counter Compare register 1.	○	
0002	ADDRESS COUNTER COMPARE REGISTER2 SET	Sets a detection value in address counter Compare register 2.	○	
0003	ADDRESS COUNTER COMPARE REGISTER3 SET	Sets a detection value in address counter Compare register 3.	○	
0010	PULSE COUNTER PRESET	Sets the initial value of the pulse counter.	○	
0011	PULSE COUNTER COMPARE REGISTER1 SET	Sets a detection value in pulse counter Compare register 1.	○	
0012	PULSE COUNTER COMPARE REGISTER2 SET	Sets a detection value in pulse counter Compare register 2.	○	
0013	PULSE COUNTER COMPARE REGISTER3 SET	Sets a detection value in pulse counter Compare register 3.	○	
001A	PULSE COUNTER MAX COUNT SET	Sets the maximum count of the pulse counter.	○	
0020	DFL COUNTER PRESET	Sets the count initial value of the pulse differential counter.	○	
0021	DFL COUNTER COMPARE REGISTER1 SET	Sets a detection value in pulse differential counter Compare register 1.	○	
0022	DFL COUNTER COMPARE REGISTER2 SET	Sets a detection value in pulse differential counter Compare register 2.	○	
0023	DFL COUNTER COMPARE REGISTER3 SET	Sets a detection value in pulse differential counter Compare register 3.	○	
002A	DFL COUNTER MAX COUNT SET	Sets the maximum count of the pulse differential counter.	○	
0031	SPEED COUNTER COMPARE REGISTER1 SET	Sets a detection value in pulse cycle counter Compare register 1.	○	
0032	SPEED COUNTER COMPARE REGISTER2 SET	Sets a detection value in pulse cycle counter Compare register 2.	○	
0033	SPEED COUNTER COMPARE REGISTER3 SET	Sets a detection value in pulse cycle counter Compare register 3.	○	
003A	SPEED OVF COUNT SET	Sets the overflow value of the pulse cycle counter.	○	

(5) HARD CONFIGURATION COMMAND

This is a special command that can be executed at all times.

HEX CODE	COMMAND NAME	Explanation	Standard function	Applied function
0001	HARD CONFIGURATION1	Sets a signal to be output to SIGNAL OUT3-0 and its axis.	○	
0002	HARD CONFIGURATION2	Sets a system (through/edge) to be output to SIGNAL OUT3-0.	○	
0003	HARD CONFIGURATION3	One-shot time at SIGNAL OUT3-0 output edge	○	
0004	HARD CONFIGURATION4	Assigns the SIGNAL IN3-0 MCC06 input function and sets an axis.	○	
0005	HARD CONFIGURATION5	Sets a general-purpose I/O batch processing function.		○
0010	PAUSE SET SPEC	Sets a PAUSE ON condition at PAUSE signal ON time.	○	
0011	PAUSE CLR SPEC	Sets a PAUSE OFF condition at PAUSE signal OFF time.	○	
0012	PAUSE	Executes PAUSE signal ON/OFF with a command.	○	
0020	HARD CONFIGURATION SET DATA READ	Reads HARD CONFIGURATION set data.	○	
0021	GPOUT	Outputs general-purpose OUT0 collectively in four axes.		○

(6) HENSA general-purpose COMMAND

HEX CODE	COMMAND NAME	Explanation	Standard function	Applied function
01	HENSA INITIALIZE1	Sets a motor type used.	○	
02	HENSA INITIALIZE2	Sets a motor resolution at step-out detection time.		○
03	HENSA INITIALIZE3	Sets an encoder motor resolution at step-out detection time.		○
04	HENSA INITIALIZE4	Sets step-out detectors 1 and 2 at step-out detection time.		○
05	HENSA INITIALIZE5	Sets rotating speed 1 upon detection of step-out.		○
06	HENSA INITIALIZE6	Sets rotating speed 2 upon detection step-out.		○
10	HENSA SET DATA READ	Reads HENSA set data.		○

(7) HENSA special COMMAND

HEX CODE	COMMAND NAME	Explanation	Standard function	Applied function
F0	ECLR	Clears a step-out error.		○

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