Melec

Stepping & Servo Motor Controller

Instructions Manual

(For designers' use)

Applied Functions Part

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CDB-5420-AL770
CAD-5410-AL770

USER'S MANUAL

Before using this product, carefully read this Instructions Manual(Applied Functions Part)to have a sufficient understanding of the application functions.
For the basic functions and basic operation procedure, be sure to read another Manual of this product.
Keep this Instructions Manual(for Application Functions) on hand so that you can refer to it whenever you want.

PR0703-6

Introduction

This User's Manual (Applied Functions Part) describes the specifications on the application function of the MCC05v2 for the designer of the control system using the stepping motor or servo motor using a controller with our Chip Controller MCC05v2 mounted on it.

When you want to use the application function of the MCC05v2, carefully read this User's Manual (Applied Functions Par) as well as the Manual to have a sufficient understanding.

Keep this User's Manual (for Application Functions) on hand so that you can refer to it whenever you want.

Description of Safety

Correct operation procedures are essential when you use application functions. If you use in a wrong way, an unexpected accident may occur to cause personal injuries or damage of your properties.

Many of the possible accidents can be avoided if you have a preliminary knowledge about dangerous situations. For this purpose, this User's Manual (Applied Functions Part) describes the precautions if any dangerous situation can be anticipated.

Such descriptions are given in terms of the following symbols and signal words.

⚠ WARNING	Death or serious injury may be caused by incorrect handling.
⚠ CAUTION	Slight injury or damage of your properties may be caused by incorrect handling.

Before use

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

- For the basic handling procedures of each controller and individual specifications, refer to the individual Manual.

Contents

The main parts which revised by this manual

1. OVERVIEW

The board controller with our Chip Controller MCC05v2 mounted on it is provided with a great variety of application functions to meet user specification requirements, in addition to the basic functions described in the Manual. This User's Manual Part Applied Functions explains such applied functions. For basic functions and basic uses of each controller, refer to our User's Manual for it.

2. SPECIFICATIONS CONCERNING APPLIED FUNCTIONS

2-1. Main Functions

(1) Applied Drive Functions

SPECIAL SCAN ·····The drive is similar to SCAN DRIVE but the speed can be adjusted during the drive.(Note)
SPECIAL INDEX·····The drive is similar to INDEX DRIVE but the speed can be adjusted during the drive.(Note)
SERIAL INDEX ·····The drive executes previously set drive patterns continuously without stop.
SPECIAL SERIAL INDEX···SERIAL INDEX DRIVE where a rate can be set for each section.
SENSOR INDEX ···Combining the INDEX DRIVE and SENSOR input detection, this drive implements the positioning.
SENSOR SCAN ·····DRIVE where SCAN DRIVE and SENSOR input detections are combined to provide positioning.

Note: This is provided for command compatibility with MCC03 as an old model. If you are studying to employ a new specifications, take these drive speed change features into consideration.

*** The description of "SCAN DRIVE" and "INDEX DRIVE" in this Manual does not include the application DRIVE.**

(2) INDEX Change Function During Drive

It enables to change the specified pulse number or the address during the INDEX DRIVE.

(3) RATE Change Function During Drive

It enables to change an acceleration/deceleration time constant during the SCAN DRIVE.

(4) DIFFERENTIAL COUNTER Input Clock Change Function

It enables to change to divide input clocks (MCC05v2 output, or pulse or EA or EB input) to the DIFFERENTIAL COUNTER. EA and EB are disabled for a controller not capable of accepting external clock input.

(5) DIFFERENTIAL COUNTER Comparator Detecting Condition Select Function

It enables to select detecting method of the DIFFERENTIAL COUNTER comparator1 and 2 from $\geqq$, $\leqq$ or $=$.

(6) DIFFERENTIAL COUNTER Compare Resistor Setup Switching Function

It enables to select an absolute value or signed value for the comparison made between the DIFFERENTIAL COUNTER and the COMPARE REGISTER.

(7) Acceleration/Deceleration Time Constant Parameter Setting Function

Acceleration/deceleration time constant can be freely set by parameter.

(8) Speed Data Setting Method Changing Function

Output pulses are generally set in Hz in the Hz setting mode, but it is possible to change this mode to the reference clock magnification setting mode, in which output pulses are set to any integer times of the reference clock.

(9) First Output Pulse Width Selecting Function

The width of the first active pulse after drive start can be selected from any of half period, 100μs fixed period and 20μs fixed period.

(10)Pulse Output Pattern Changing Function

Pulse output pattern is generally separate between CW and CCW, but this can be changed to the direction designated output pattern.

(11)Triangular Drive Prevention Function

In order to avoid the triangular drive which starts decelerating without reaching the high speed in the S-RATE INDEX DRIVE due to shortage of pulse number, this function enables to designate pulse number for the top constant speed in advance and to secure constant speed operating ranges.

(12)END PULSE Drive Function

In order to reduce damping at the end of the INDEX DRIVE and the S-RATE INDEX DRIVE, this function enables to make a continuous drive of designated frequency and of designated pulse number after the end of deceleration up to the low speed.

(13)Origin Drive Direction Changing Function

The precondition for origin drive is that the $\overline{ORG}$ (or $\overline{NORG}$) sensor has been installed at the -(CCW) limit side along works, but the origin drive direction changing function enables to install the $\overline{ORG}$ (or $\overline{NORG}$) sensor on the +(CW) limit side.

(14)Margin Time Function

In order to prevent the origin drive from malfunctioning due to hunting, this function enables to insert a margin time between the sensor signal detection and the pulse stop.

(15)SOFT LIMIT Function

This function allows you to set up CW or CCW SOFT LIMIT.

(16)DEND ERROR Detection Function

If active level of $\overline{DEND}$ signal is not returned during the predetermined time span, this function ends the drive forcibly by setting 1 to the error bit of STATUS1 PORT.

(17)Origin Sensor Type Select Function

This function allows you to switch the $\overline{ORG}$ sensor detection approach from the edge sensing to the level sensing.

(18)ORIGIN ERROR Detection Function

Specifying the maximum number of pulses to be output during the CONSTANT SCAN DRIVE process and JOG DRIVE process, this function can end the drive forcibly if the sensor fails to make detection during that range of pulse number.

(19)PO Input Function

This function offers origin detection utilizing PO (excitation) output signal from stepping motor drivers. When PO input is enabled, ANDing of $\overline{PO}$ signal and $\overline{ORG}$ signal is output as $\overline{ORG}$ signal.

(20)AUTO DRST Output Function

This function automatically outputs $\overline{DRST}$ signal as the machine origin detection completed.

(21)Special DRST Output Function

This function allows you to constantly generate $\overline{DRST}$ output.

(22) Asymmetric S-RATE DRIVE function

Acceleration/deceleration constant can be set separately in the S-shaped DRIVE.

(23) S-RATE DRIVE triangular drive workaround function

The DRIVE profile is rounded automatically when there are few output pulses in the S-shaped DRIVE, thereby working around the triangular drive. It should be noted, however, that this is disabled in the asymmetric S-RATE DRIVE.

(24) SPEED/RATE CHANGE speed increase function

The operation from the writing of CHANGE command is performed on the real time basis in the SCAN DRIVE.

(25) AUTO CHANGE function

The SPEED and RATE are changed automatically according to the preset number of output pulses, speed or time.

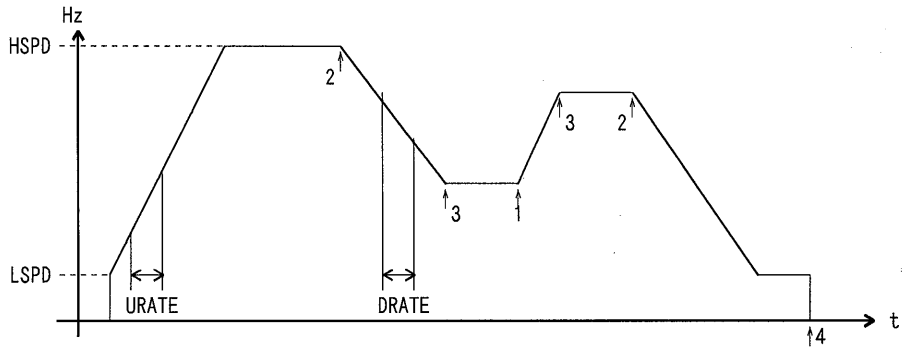
(26) DRIVE calculation function

The number of acceleration pulses, acceleration time and INDEX DRIVE drive time can be obtained by simulated calculation.

3. APPLIED DRIVE FUNCTION

3-1. SPECIAL SCAN1 DRIVE Function

This function accelerating/decelerating drive by the +/-SPECIAL SCAN1 Command.
Drive speed can be changed by inputting any of UP (acceleration), DOWN (deceleration) and CONSTANT (constant speed).



1. UP (Acceleration) : When UP data are written in the DRIVE DATA1 PORT,an acceleration drive at the URATE (acceleration time constant) will occur at the time of constant speed or deceleration.
   When the speed reaches the HSPD (high speed) after acceleration, a constant drive at the HSPD will occur.

2. DOWN (Deceleration) : When DOWN data are written in the DRIVE DATA1 PORT,an deceleration drive at the DRATE (deceleration time constant) will occur at the time of constant speed or deceleration.
   When the speed reaches the LSPD (low speed) after deceleration, a constant drive at the LSPD will occur.

3. CONSTANT : When constant data are written in the DRIVE DATA1 PORT, a constant speed drive at the speed at the time of writing will occur at the time of acceleration or deceleration.

4. Stop Command : Means a stop command for any of slow stop, fast stop and limit stop.

Data required for SPECIAL SCAN1 DRIVE are as follows:

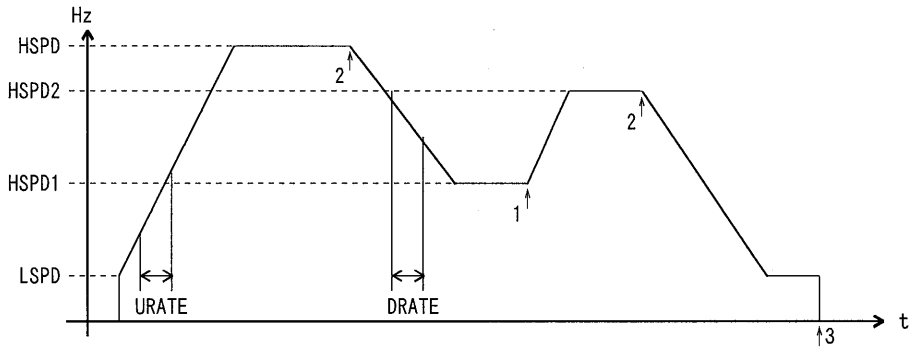
Data names	Setting command
HSPD(HIGH SPEED)	HSPD SET
LSPD(LOW SPEED)	LSPD SET
URATE(acceleration time constant)	RATE SET
DRATE(deceleration time constant)	RATE SET
UP(Acceleration)	This is not a COMMAND.
DOWN(deceleration)	This is not a COMMAND.
CONSTANT(constant speed)	This is not a COMMAND.

Notes:

1. When LSPD≧HSPD is specified, a constant-speed drive is performed with HSPD.
2. UP, DOWN and CONSTANT data have to be written once, and the drive will continue until any different data are written.
3. When any data other than UP, DOWN and CONSTANT data are written in the DRIVE DATA1 PORT, such data will be neglected. Also, when any invalid data have already been written before start of drive, an acceleration drive will occur.
4. During deceleration by a slow stop command, UP and CONSTANT commands will be neglected.

3-2. SPECIAL SCAN2 DRIVE Function

This function accelerating/decelerating drive by the +/-SPECIAL SCAN1 Command.
A speed change is made to the speed to be obtained by HSPD No. by designating any HSPD No. during drive.



1. When a change speed to be designated by HSPD No. is faster than the speed at the time of writing, an acceleration drive at the URATE (acceleration time constant) will occur.
   When the speed reaches a change speed after the acceleration, a constant speed drive at the change speed will occur. If the change speed is faster than the HSPD, however, a constant speed drive at the HSPD will occur when the speed reaches the HSPD after the acceleration.

2. When a change speed to be designated by HSPD No. is slower than the speed at the time of writing, a deceleration drive at the DRATE (deceleration time constant) will occur.
   When the speed reaches the change speed after the deceleration, a constant speed drive at the change speed will occur. If the change speed is slower than the LSPD, however, a constant speed drive at the LSPD will occur when the change speed reaches the LSPD after the deceleration.

3. A command of any stop of gradual stop, immediate stop and limit stop is indicated.

Data required for SPECIAL SCAN2 DRIVE are as follows:

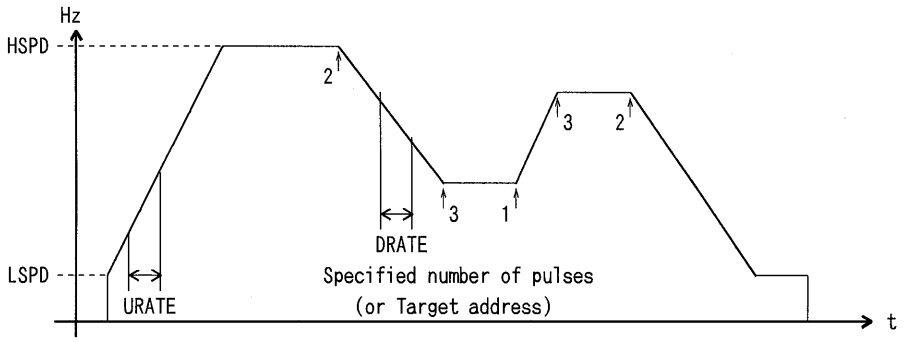
Data names	Setting command
HSPD(HIGH SPEED)	HSPD SET
LSPD(LOW SPEED)	LSPD SET
URATE(acceleration time constant)	RATE SET
DRATE(deceleration time constant)	RATE SET
HSPD1～10(change speed)	PART HSPD BUFFER SET AND PART HSPD SET

Notes:

1. When LSPD≧HSPD is specified, a constant-speed drive is performed with HSPD.
2. The setting range of HSPD1 to 10 is LSPD ≦ HSPD1 to 10 ≦ HSPD. In case of outside the range, the speed will be LSPD or HSPD.
3. To designate a HSPD No, just write the HSPD No. in the DRIVE DATA1 PORT, and it is valid until a different HSPD No. is written.
4. When an invalid No. is written in the DRIVE DATA1 PORT, the data will be neglected.
   Also, if an invalid data have been written before the start of a drive, an acceleration drive at any speed up to HSPD will occur.
5. During deceleration by a slow stop command, the speed No. will be neglected.
6. The ten HSPD Nos. from HSPD1 to HSPD10 can be used. This HSPD No. is used together with PART HSPD to be used for SERIAL INDEX DRIVE to be explained later.
   When the both drives are used together, manage data very carefully.

3-3. SPECIAL INDEX1 DRIVE Function

Accelerating/decelerating drive is performed with the specified number of pulses (or up to the target address)by the SPECIAL INDEX1 Command.
The drive speed can be changed by giving any command of UP (acceleration), DOWN (deceleration) and CONSTANT (constant speed) during drive.
To start the drive, URATE should be equal to DRATE.



1. UP (Acceleration) : When UP data are written in the DRIVE DATA1 PORT,an acceleration drive at the URATE (acceleration time constant) will occur at the time of constant speed or deceleration.
   When the speed reaches the HSPD (high speed) after acceleration, a constant drive at the HSPD will occur.

2. DOWN (Deceleration) : When DOWN data are written in the DRIVE DATA1 PORT,an deceleration drive at the DRATE (deceleration time constant) will occur at the time of constant speed or deceleration.
   When the speed reaches the LSPD (low speed) after deceleration, a constant drive at the LSPD will occur.

3. CONSTANT : When constant data are written in the DRIVE DATA1 PORT, a constant speed drive at the speed at the time of writing will occur at the time of acceleration or deceleration.

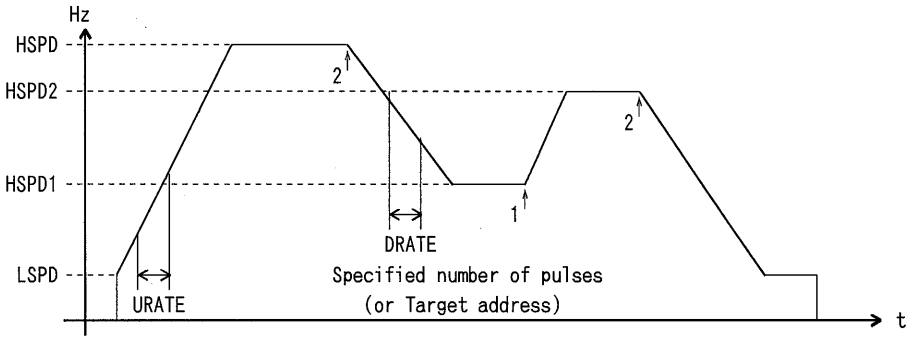
Data required for SPECIAL INDEX1 DRIVE are as follows:

Data names	Setting command
HSPD(HIGH SPEED)	HSPD SET
LSPD(LOW SPEED)	LSPD SET
URATE(acceleration time constant)	RATE SET
DRATE(deceleration time constant)	RATE SET
Specified number of pulses (target address)	INCREMENTAL/ABSOLUTE DATA SET
UP(acceleration)	This is not a COMMAND.
DOWN(deceleration)	This is not a COMMAND.
CONSTANT(constant speed)	This is not a COMMAND.

Notes:
1. When LSPD≧HSPD is specified, a constant-speed drive is performed with HSPD.
2. When LSPD<HSPD and URATE≠DRATE are specified, a command error will occur and no perform drive.
3. UP, DOWN and CONSTANT data have to be written once, and the drive will continue until any different data are written.
4. When any data other than UP, DOWN and CONSTANT data are written in the DRIVE DATA1 PORT, such data will be neglected. Also, when any invalid data have already been written before start of drive, an acceleration drive will occur.
5. During deceleration to stop at specified number of pulses(or target address) or during deceleration by a slow stop command, UP and CONSTANT commands will be neglected.

3-4. SPECIAL INDEX2 DRIVE Function

Accelerating/decelerating drive is performed with the specified number of pulses (or up to the target address)by the SPECIAL INDEX2 Command.
A speed change is made to the speed to be obtained by HSPD No. by designating any HSPD No. during drive.



1. When a change speed to be specified by HSPD No. is faster than the speed at the time of writing, an acceleration drive at the URATE (acceleration time constant) will occur.
   When the speed reaches a change speed after the acceleration, a constant speed drive at the change speed will occur. If the change speed is faster than the HSPD, however, a constant speed drive at the HSPD will occur when the speed reaches the HSPD after the acceleration.

2. When a change speed to be specified by HSPD No. is slower than the speed at the time of writing, a deceleration drive at the DRATE (deceleration time constant) will occur.
   When the speed reaches the change speed after the deceleration, a constant speed drive at the change speed will occur. If the change speed is slower than the LSPD, however, a constant speed drive at the LSPD will occur when the change speed reaches the LSPD after the deceleration.

Data required for SPECIAL INDEX1 DRIVE are as follows:

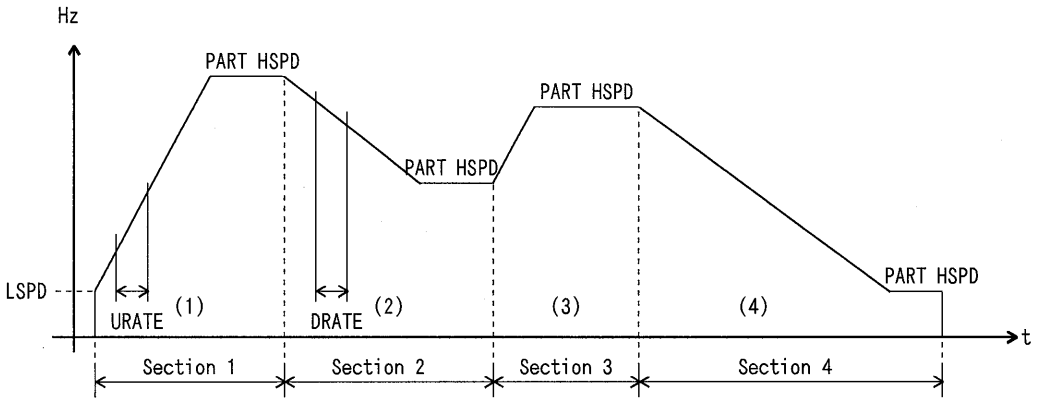
Data names	Setting command
HSPD(HIGH SPEED)	HSPD SET
LSPD(LOW SPEED)	LSPD SET
URATE(acceleration time constant)	RATE SET
DRATE(deceleration time constant)	RATE SET
Specified number of pulses (target address)	INCREMENTAL/ABSOLUTE DATA SET
HSPD1～10(Change speed. Up to 10 speeds can be sets.)	PART HSPD BUFFER SET AND PART HSPD SET

Notes:
1. When LSPD≧HSPD is specified, a constant-speed drive is performed with HSPD.
2. When LSPD<HSPD and URATE≠DRATE, a command error will occur and no drive will occur.
3. The setting range of HSPD1 to 10 is LSPD≦HSPD1 to 10 ≦HSPD.
   In case of outside the range, the speed will be LSPD or HSPD.
4. To designate a HSPD No, just write the HSPD No. in the DRIVE DATA1 PORT, and it is valid until a different HSPD No. is written.
5. When an invalid No. is written in the DRIVE DATA1 PORT, the data will be neglected.
   Also, if an invalid data have been written before the start of a drive, an acceleration drive at any speed up to HSPD will occur.
6. During deceleration to stop at a designated pulse number (or target address) or during deceleration by a slow stop command, the speed No. will be neglected.
7. The ten HSPD Nos. from HSPD1 to HSPD10 can be used.
   This HSPD No. is used together with PART HSPD to be used for SERIAL INDEX DRIVE to be explained later.
   When the both drives are used together, manage data very carefully.

3-5. SERIAL INDEX DRIVE Function

An accelerating/decelerating drive is performed with the specified number of pulses and change speed is made according to data preset by the +/-SERIAL INDEX Command.
Speeds can be set in up to 10 sections, and pulse numbers can be set in respective sections.
No stop occurs at boundaries between sections.

Example of Four Sections :



Data required for SERIAL INDEX DRIVE are as follows:

Data names	Setting command
PART HSPD(High speed in each section. Up to 10 speeds can be set.)	PART HSPD BUFFER SET AND PART HSPD SET
LSPD(LOW SPEED)	LSPD SET
URATE(Acceleration time constant common to each section)	RATE SET
DRATE(Deceleration time constant common to each section)	RATE SET
PART PULSE(specified number of pulses in each section from (1) to (4). Up to 10 pulse numbers can be set.)	PART PULSE SET

Notes:

1. The maximum pulse number in each section is 1,048,575 pulses.
   The total pulse number for SERIAL INDEX DRIVE is the total of pulse numbers of all sections.
2. A drive starts from Section 1 and ends just before the section where the part pulse is 0.
   So, when the number of sections is less than 10, it is necessary to set the part pulses of unnecessary sections to 0.
3. When the set pulse number for each section is smaller than the one necessary to adjust the speed to the PART HSPD in each section, all such sections will become speed adjusting areas.
   Also, when the PART PULSE in any of Sections 2 to 9 is smaller than the specified pulse number expressed by the following formula, the section will be judged invalid and the PART PULSE of the section will be unconditionally added in the previous valid section for correction.
   Take notice of this. But, this limit does not apply to the last section.

$$\text{Specified pulse number} = \frac{0.00006}{T_{p\,(SEC)}} + 35$$

   where, Tp : Period of the highest PART HSPD among Sections 2 to 10.
4. When the PART PULSE in Section 1 is smaller than the specified pulse number expressed by the following formula, a command error will occur and no drive will occur.
   Take notice of this.

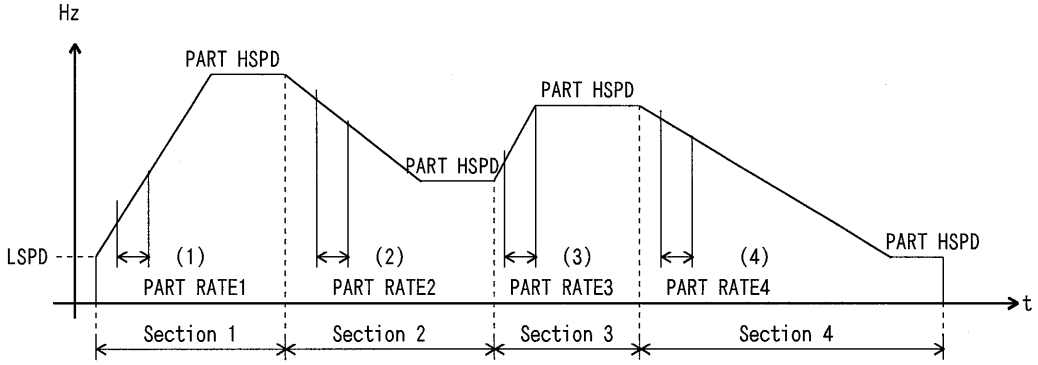
$$\text{Specified pulse number} = \frac{0.00006}{T_{p\,(SEC)}} + 2$$

   where, Tp : Period of PART HSPD in Section 1
5. The pulse output will stop with the PART HSPD in the last section of a drive.
   So, it is necessary to make the PART HSPD in the last section close to the LSPD.
   In case of a gradual stop halfway in the SERIAL INDEX DRIVE, the drive may be terminated with the remaining pulse number at the time of internal detection of deceleration command without deceleration.
   Take notice of this. If the deceleration command input timing is close to a section boundary of SERIAL INDEX, the internal detection of the deceleration command may be delayed. Take notice of this.
6. When the PART HSPD in Section 1 is slower than the LSPD, a constant speed drive at the LSPD will occur in Section 1. When the PART HSPD in any other section is slower than the LSPD, the PART HSPD will become equal to the LSPD.

3-6. SPECIAL SERIAL INDEX DRIVE Function

An acceleration/deceleration drive is performed with the specified pulse number (including change on the speed and rate) is made according to the data preset by the +/-SPECIAL SERIAL INDEX Command.
Speeds can be set in up to 10 sections, and pulse numbers can be set in respective sections.
No stop occurs at boundaries between sections.

Example of Four Sections :



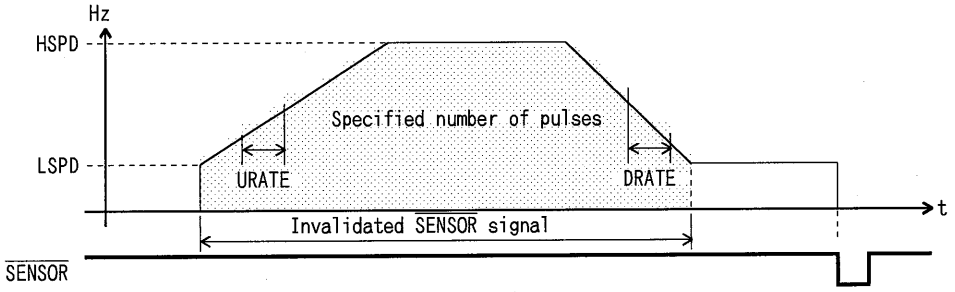
Data required for SPECIAL SERIAL INDEX DRIVE are as follows:

Data names	Setting command
PART HSPD(High speed in each section. Up to 10 speeds can be set.)	PART HSPD BUFFER SET and PART HSPD SET
LSPD(LOW SPEED)	LSPD SET
PART RATE(Acceleration or Deceleration time constant common to each section)	PART RATE SET
PART PULSE(specified number of pulses in each section from (1) to (4). Up to 10 pulse numbers can be set.)	PART PULSE SET

The same notes as for the SERIAL INDEX DRIVE apply to this SPECIAL SERIAL INDEX DRIVE, too.

3-7. SENSOR INDEX1 DRIVE Function

The continue drive until $\overline{\text{SENSOR}}$ signal detect is performed by the SENSOR INDEX1 DRIVE Command.
When acceleration/deceleration with a specified pulse number is completed, this drive shifts to constant drive at LSPD (without stopping) until low level (active) of SENSOR signal is detected.
Specified pulse number can be set within the range of +/-8,388,607 with the maximum pulse number 16,777,215.
If $\overline{\text{SENSOR}}$ signal is not detected within this range, the drive comes to stop.
$\overline{\text{SENSOR}}$ signal may not be provided to all axes. For details, refer to the USER'S MANUAL of each controller.



Data required for SENSOR INDEX1 DRIVE are as follows:

Data names	Setting command
HSPD(HIGH SPEED)	HSPD SET
LSPD(LOW SPEED)	LSPD SET
URATE(acceleration time constant)	RATE SET
DRATE(deceleration time constant)	RATE SET
Specified number of pulses	When SENSOR INDEX1 is started

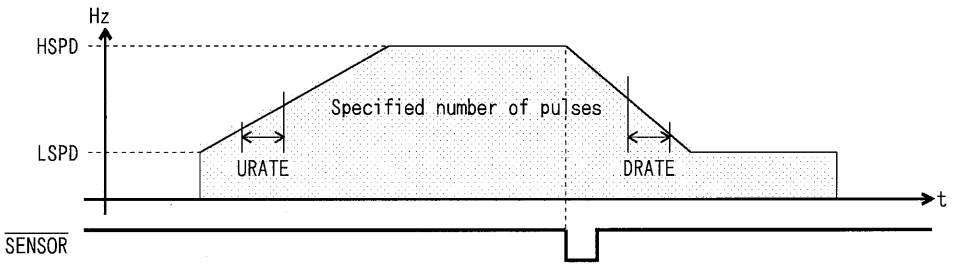
Notes:

1. As long as acceleration/deceleration drive continues for the specified pulse numbness, $\overline{\text{SENSOR}}$ signal is invalidated. $\overline{\text{SENSOR}}$ detection is turned on only after the specified pulse number has been output.
2. When LSPD≧HSPD is specified, a constant-speed drive is performed with HSPD.
   In this case, $\overline{\text{SENSOR}}$ signal generating output of a specified pulse number is also invalidated.
3. Refer to the following formula for pulse numbers output after $\overline{\text{SENSOR}}$ signal has been detected.

$$\text{PULSE} \leqq \text{LSPD(Hz)} \times 3 \times 10^{-6} + 1$$

3-8. SENSOR INDEX2 DRIVE Function ®2

Accelerating/decelerating drive is performed with the specified number of pulses by the SENSOR INDEX2 Command. As $\overline{\text{SENSOR}}$ signal goes low level (active) during the drive, this drive decelerates to LSPD, then (without stopping) shifts to constant drive until the specified pulse number is reached.
$\overline{\text{SENSOR}}$ signal may not be provided to all axes. For details, refer to the USER'S MANUAL of each controller.



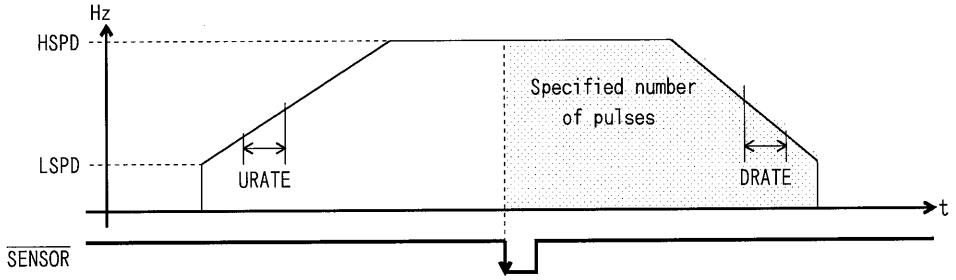
Data required for SENSOR INDEX2 DRIVE are as follows:

Data names	Setting command
HSPD(HIGH SPEED)	HSPD SET
LSPD(LOW SPEED)	LSPD SET
URATE(acceleration time constant)	RATE SET
DRATE(deceleration time constant)	RATE SET
Specified number of pulses	When SENSOR INDEX2 is started

Notes:
1. When LSPD≧HSPD is specified, a constant-speed drive is performed with HSPD. thus invalidating $\overline{\text{SENSOR}}$ signal.
2. If $\overline{\text{SENSOR}}$ signal is not entered, the index drive at a specified pulse number is turned on.

3-9. SENSOR INDEX3 DRIVE Function

After $\overline{\text{SENSOR}}$ signal has been detected, the index drive at a specified pulse number is made according to SENSOR INDEX3 DRIVE Command. As turned on, this drive functions the same as the SCAN DRIVE.
Then, as $\overline{\text{SENSOR}}$ signal goes low (active), index drive at the specified pulse number takes place before it is stopped. 0 may not be selected for a specified number of pulses.
$\overline{\text{SENSOR}}$ signal may not be provided for all axes. For details, refer to the USER'S MANUAL of each controller.



Data required for SENSOR INDEX1 DRIVE are as follows:

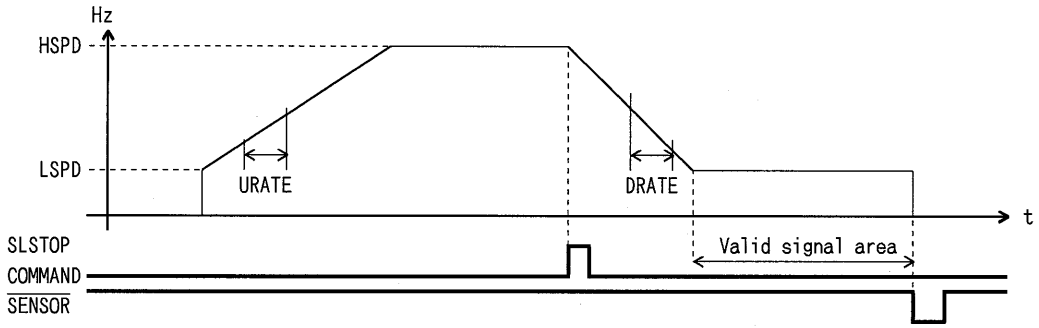
Data names	Setting command
HSPD(HIGH SPEED)	HSPD SET
LSPD(LOW SPEED)	LSPD SET
URATE(acceleration time constant)	RATE SET
DRATE(deceleration time constant)	RATE SET
Specified number of pulses	When SENSOR INDEX3 is started

Notes:
1. When LSPD≧HSPD is specified, a constant-speed drive is performed with HSPD.
2. The maximum drive speed may not exceed the one that allows to make a gradual stop as the specified pulse number is reached. Note that desired speed may not be provided if a specified pulse number is small.
3. Unlike the SENSOR INDEX1,2 DRIVE, this drive is activated with the sensor active edge. Pulse number that is output according to input of active edge remains the same as that generated in SENSOR INDEX3 DRIVE.
4. Whenever implementing the SENSOR INDEX3 DRIVE, the SENSOR INDEX3 DATA SET Command must be executed beforehand. Otherwise, an error is indicated and, thus, the operation is not available. Refer to 15-7.
5. A sensor signal should input once signal without a chataring.

3-10. SENSOR SCAN1 DRIVE Function

DRIVE up to detection of the $\overline{\text{SENSOR}}$ signal can be performed by the SENSOR SCAN1 command. This DRIVE is a SCAN DRIVE. Stop is not actuated by the slow stop command (SLSTOP). Constant speed drive is performed by the LSPD and stop is actuated when the low level (active) of the $\overline{\text{SENSOR}}$ signal is detected. This is especially useful for application in rotary system.

In this DRIVE, the SPEED/RATE change is enabled until the slow stop command (SLSTOP) is input. $\overline{\text{SENSOR}}$ input signals may not be provided for all axes. For details, refer to the Manual of each controller.



Data required for SENSOR SCAN1 DRIVE are as follows:

Data names	Setting command
HSPD(HIGH SPEED)	HSPD SET
LSPD(LOW SPEED)	LSPD SET
URATE(acceleration time constant)	RATE SET
DRATE(deceleration time constant)	RATE SET

Notes:

1. $\overline{\text{SENSOR}}$ signals are ignored during the deceleration. (This is because the $\overline{\text{SENSOR}}$ may turn on several times during the deceleration in the rotation system) In the constant speed drive mode, it is enabled immediately after SLSTOP command input.

2. In this DRIVE, the DRIVE cannot be stopped by the SLSTOP command. So the SSEND BIT in the STATUS1 PORT has no sense. It can be stopped by FSSTOP, LIMIT and SOFT LIMIT.

3. The following equation shows the number of pulses to be output after detection of $\overline{\text{SENSOR}}$ signals:

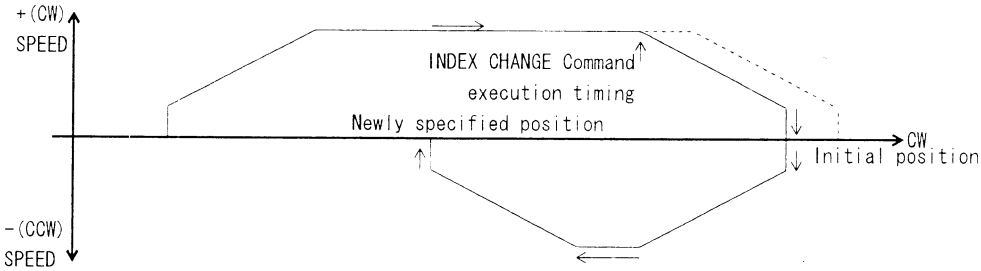
$$\text{PULSE} \leqq \text{LSPD(Hz)} \times 4 \times 10^{-6} + 1$$

3-11. INDEX CHANGE Furction During Drive R6

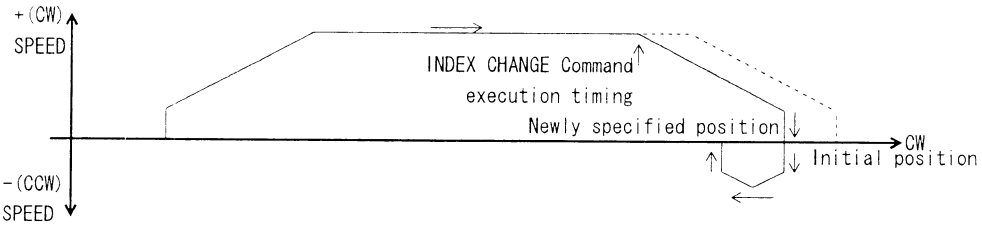
Using INDEX CHANGE Command allows you to change a specified pulse number or address while the INDEX DRIVE or S-RATE INDEX DRIVE is taking place. (When the INDEX CHANGE is executed, initial data specified at the start is ignored and data being set up after the change is made valid for the operation.)

The following change takes place in the operation according to the data provided through the INDEX CHANGE Command.

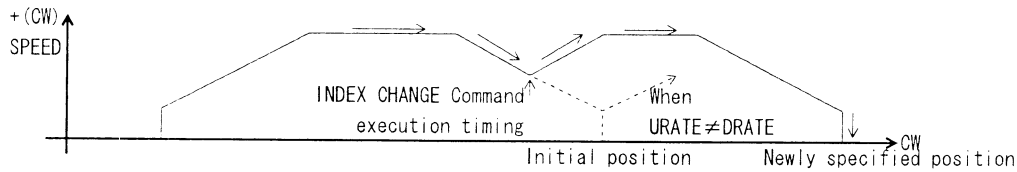
① If a point specified in the new data has already been passed over, the operation is decelerated until stops, then it reverses to the point past-by. (This holds true when, in the INDEX ADDRESS, the new address specified is located in the opposite direction of the original address.)



② When the gradual LSPD drive has passed over a newly specified position, the operation is reversed from the poirt it stopped toward that position.



③ When the specified pulse number is increased according to the INDEX CHANGE, the drive speed is accelerated. When URATE≠DRATE is specified, acceleration is turned on only after the speed has once been decelerated to LSPD.



Notes:

1. When URATE≠DRATE is specified, INDEX CHANGE Command issued during acceleration is processed after constant drive has been turned on. In this case, the maximum speed may not reach HSPD depending on a pulse number given at the start of the drive.
2. When the drive is paused with INDEX CHANGE, a SCAN DELAY TIME is inserted after the pause. In this case, a speed specified with SPEED CHANGE is invalidated in the resumed drive.
3. This funct on is invalid in SPECIAL INDEX1 and 2 DRIVE.
4. As long as deceleration is carried out according to SLSTOP Command, INDEX CHANGE is invalid. INDEX CHANGE is also invalid when DRIVE BIT=0. In this case, 1 is set to ERROR BIT of STATUS1 PORT.
5. When a change is requested with INDEX CHANGE Command, another change request using the same command is ignored until the preceding request is internally accepted. You can check if INDEX CHANGE Command is executable or not from INDEX CHANGE BUSY BIT on STATUS5 PORT, so you are advised to check the state before executing this command.
6. In the INCREMENTAL DRIVE, do not use the INDEX CHANGE if the ADDRESS COUNTER overflows during indexing operation. If the INDEX CHANGE is used with the ADDRESS COUNTER overflown, output pulses may not be guaranteed.
7. INDEX CHANGE of one INDEX DRIVE to reverse is up to once.

3-12. RATE CHANGE Function During Drive

During the SCAN DRIVE, you can change an acceleration/deceleration time constant using RATE CHANGE Command. Rate data changed with RATE CHANGE Command is valid on in the drive the command is issued.

Notes:

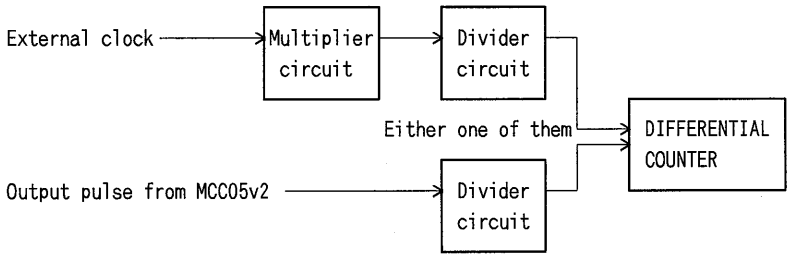
1. This function is invalid in SPECIAL SCAN1 and 2, and S-RATE SCAN DRIVE.
2. If you try to change a rate when SOFT LIMIT is turned on, you may encounter troubles such as **the one in which the drive is stopped instantaneously without going through the LSPD stage or the one in which the drive is continued over a long period at the LSPD.**
3. When a rate change is requested with RATE CHANGE Command, another change is ignored until the preceding request is internally accepted. You can check if RATE CHANGE Command is executable or not from RATE CHANGE BUSY BIT on STATUS5 PORT, so you are advised to check the state before executing this command.

4. DIFFERENTIAL COUNTER APPLICATION

In addition to basic functions, the DIFFERENTIAL COUNTER has the following setup functions to meet special applications.

4-1. Dividing Function for Clock Input to DIFFERENTIAL COUNTER.

Although input clock (output pulse from MCC05v2, or EA or EB input) to the DIFFERENTIAL COUNTER is normally entered at the ratio of 1 : 1, it is possible to divide one of them before it is entered into the counter. When EA or EB input is selected, multiplication function can also be used in parallel.
Using this function allows you to enter the deviation on a system where the ratio between output pulse and feedback pulse is not 1 : 1.
DFL DIVISION DATA SET Command is available for selecting input clock to be divided between MCC05v2 output pulse, or EA or EB input. It is also usable for specifying division conditions.
External clock input is not offered for some products. For details, refer to the USER'S MANUAL of each controller.



4-2. DIFFERENTIAL COUNTER COMPARATOR Detecting condition select Function

Normally, the DIFFERENTIAL COUNTER comparator1 detects the DIFFERENTIAL COUNTER≧COMPARE REGISTER1 (excessive difference) and the DIFFERENTIAL COUNTER comparator2 detects the DIFFERENTIAL COUNTER≦COMPARE REGISTER2 (positioning complete).
This function, however, allows you to use ≧, ≦ or = to determine relative measure between them.
Switching of the function is available from DFL COUNTER INITIALIZE Command.

4-3. DIFFERENTIAL COUNTER COMPARE REGISTER Setup change Function

Although absolute value is normally set on the DIFFERENTIAL COUNTER COMPARE REGISTERs 1 and 2, this function allows you to use a signed number for the setting.
This function enables, for instance, to use negative or positive numbers to represent a detected error.
Switching of the function is available from DFL COUNTER INITIALIZE Command.

5. ACCELERATION/DECELERATION TIME CONSTANT PARAMETER SETTING FUNCTION (ARITHMETIC MODE)

5-1. Explanation of Function

Time constant can be set to any value by designating DRIVE TYPE as the Arithmetic Mode by the SPEC INITIALIZE1 Command. This function will become valid when user's RATE specification does not include the RATE DATA TABLE. Parameters necessary to set acceleration/deceleration time constants are RATE to determine speed change timing and RESOLUTION to determine speed differences at the time of speed change. Actual acceleration/deceleration time constants can be approximated by the following formula by using the two parameters:

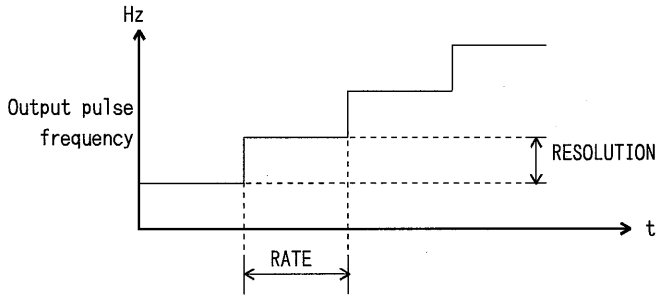
$$\text{Acceleration/Deceleration Time Constant} \fallingdotseq 1.537 \times 10^{-2} \times \frac{R}{D} \quad (\text{msec}/1000\text{Hz}) \cdots\cdots\cdots\cdots (A)$$

where, R : RATE DATA, D : RESOLUTION DATA

So, acceleration/deceleration time constants suitable for user's specification can be obtained from Formula (A) by adjusting values of R and D.

5-2. Detail of Specification for Adjusting Speed of MCC05v2

The speed of MCC05v2 is adjusted by adding or reducing specified speed difference every certain time. This adjustment is shown in the figure below:



In the other words, the speed adjustment is controlled by two parameters, i.e.,RATE for time axis direction and RESOLUTION for output pulse frequency axis direction. To set these parameters for determining actual time constants, it is general to determine speed difference (RESOLUTION) suitable for the applicable motor and mechanism at the time of speed change and then to calculate the timing (RATE) to realize the target time constant.

5-3. Explanation of RESOLUTION DATA

RESOLUTION DATA are set to determine speed difference at the time of speed change in each speed area. The speed difference is not constant in all speed areas and increases as the speed increases. The speed halfway during the speed adjustment can be expressed as follows:

$$F_{UD} = \frac{160{,}000{,}000}{INT\{INT(3{,}145{,}680/D)/C\}} \quad (Hz) \cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots (B)$$

where, F_{UD} : Halfway speed, D : RESOLUTION DATA
C : Speed control data
INT{ }: denotes the integer part with all digits to the right of decimal point discarded.

When the speed of MCC05v2 is increased, C is the increment, and when the speed is reduced, D is the decrement.
So, the Fup value difference due to change of C value becomes the speed difference at the time of speed change. RESOLUTION DATA are 1byte data (1 to 255) common to acceleration and deceleration and are specified by the RESOLUTION SET Command.
As the RESOLUTION DATA value increases, the speed difference will become large.
The following shows the RESOLUTION value for each TYPE when the Fixed Mode is selected:
L-TYPE=1. M-TYPE=20. H-TYPE=200.

5-4. Explanation of RATE DATA

Speed change timing (period) is determined by setting the RATE DATA.(RATE cycle)
As explained in 5-3, speed differences at the time of speed change are determined by setting RESOLUTION DATA. In addition, time constants at the time of speed change can be determined by setting RATE DATA. The RATE DATA can be calculated by the following approximate expression:

$$R \fallingdotseq 63.58 \times D \times T_{UD} \cdots\cdots (C)$$

where, R : RATE DATA, D : RESOLUTION DATA
T_{UD} : Acceleration/deceleration time constant in user's specification, msec/1000Hz

The RATE DATA (2byte) setting range is from 64 (40_H) to 65,535 ($FFFF_H$). RATE DATA for acceleration can be separately set from those for deceleration in all drives other than S-RATE SCAN, S-RATE INDEX and SPECIAL INDEX. For the setting, the RATE SET Command or the SRATE SET Command is used.

5-5. Example of Data Setting

When the acceleration/deceleration time constant, T_{UD} is 2msec/1000Hz and the RESOLUTION DATA, D is 1, the RATE DATA, R is calculated as follows by using Formula (C):

$$R \fallingdotseq 63.58 \times D \times T_{UD} \fallingdotseq 63.58 \times 1 \times 2 \fallingdotseq 127$$

5-6. Precautions in Use of Arithmetic Mode

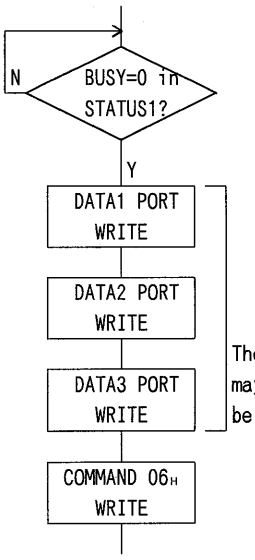
Please note that data to be specified in the data port at the time of execution of Commands such as RATE SET, SRATE SET, SSRATE ADJUST and SERATE ADJUST in the Arithmetic Mode are different from those in the Fixed Mode. The following shows the sequence to execute above Commands in the Arithmetic Mode:

(1) RATE SET Command

COMMAND····· 06_H

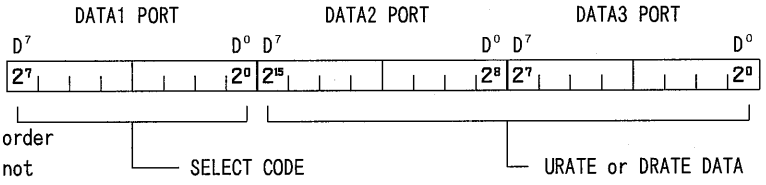
Function : To designate URATE (acceleration time constant) and DRATE (deceleration time constant) necessary for acceleration/deceleration drive by the parameter DATA.

Execution Sequence



Set URATE or DRATE data in the DRIVE DATA2 or 3 PORT as 2byte data.
Specified which data is set, URATE or DRATE, to the DRIVE DATA1 PORT.

The contents of the DRIVE DATA1 PORT to DRIVE DATA3 PORT are as follows.



The RATE DATA setting range is from 64 (40_H) to 65,535($FFFF_H$).
Function of SELECT CODE are as follows:

CODE	Functions
00_H	URATE SET
01_H	DRATE SET
02_H	URATE,DRAT are set at the same time.
Other than the above	COMMAND ERROR

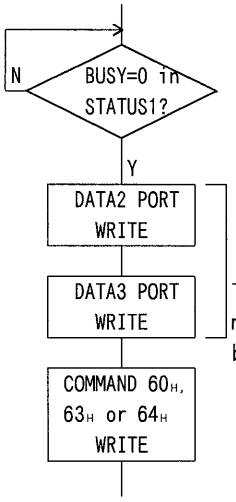
(2) SRATE SET,SSRATE ADJUST,SERATE ADJUST Command

COMMAND····· 60_H Function : To designate SRATE necessary for S-RATE DRIVE by the parameter Data.

COMMAND····· 63_H Function : To adjust SSRATE (acceleration start or deceleration end time constant) necessary for S-RATE DRIVE by the parameter DATA.

COMMAND····· 64_H Function : To adjust SERATE (acceleration end or deceleration start time constant) necessary for S-RATE DRIVE by the parameter DATA.

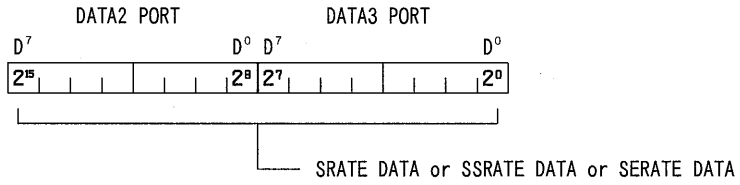
Execution Sequence



The order may not be observed.

2byte data are set to the DRIVE DATA2 and 3 PORTs.

The contents of the DRIVE DATA2 PORT and DRIVE DATA3 PORT are as follows.



The maximum data setting range is from $64(4D_H)$ to $65,535(FFFF_H)$.
However the setting range of SSRATE and SERATE is from SRATE to 65,535.

6. SPEED DATA SETTING METHOD CHANGING FUNCTION

6-1. Explanation of Function

Speed is generally set as 3byte data in Hz, and it can be designated by integer times data of the reference clock(40MHz). At the time, the data setting range is from 48 to 16,777,215 and the speed range to be designated is from about 9.5Hz to 3.3MHz. When the multiple data of the reference clock(40MHz) is V, the output frequency, F, can be calculated by the following formula:

$$F = \frac{160,000,000}{V} \quad (Hz)$$

To change the speed data setting method, the SPEC INITIALIZE3 Command is used.

6-2. Stability of Output Pulse Frequency

Output pulses can be obtained by dividing the half division, 20MHz, of the reference clock frequency, 40MHz. So, please note in advance that the output pulse frequency becomes stable only when the output pulse period is integer times of 50nsec.

6-3. Precautions in Use of Reference Clock Multiple Setting Mode

Please note carefully that data to be designated to the data port at the time of executing commands such as LSPD SET, HSPD SET, CSPD SET, SLSPD SET, SHSPD SET, SCSPD1 ADJUST, SCSPD2 ADJUST, PART HSPD BUFFER SET, ESPD SET, SESPD SET and SPEED CHANGE in the Reference Clock Multiple Setting Mode are different from those in the Hz Setting Mode.

The following shows the execution sequences of the above commands in the Reference Clock Multiple Setting Mode:

(1) Explanation of Commands and Execution Sequence

COMMAND····· 07_H Function : To set LSPD necessary for drive.

COMMAND····· 08_H Function : To set HSPD necessary for drive.

COMMAND····· $1A_H$ Function : To set CSPD necessary for ORG DRIVE.

COMMAND····· 23_H Function : To set PART HSPD necessary for SERIAL INDEX DRIVE

COMMAND····· 19_H $2E_H$ Function : To set ESPD,SESPD necessary for END PULSE DRIVE

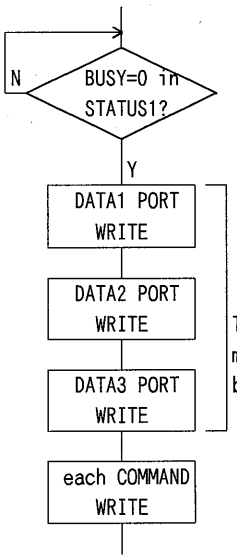
COMMAND····· 61_H Function : To set SLSPD necessary for S-RATE DRIVE.

COMMAND····· 62_H Function : To set SHSPD necessary for S-RATE DRIVE.

COMMAND····· 65_H Function : To set SCSPD1 necessary for S-RATE DRIVE.

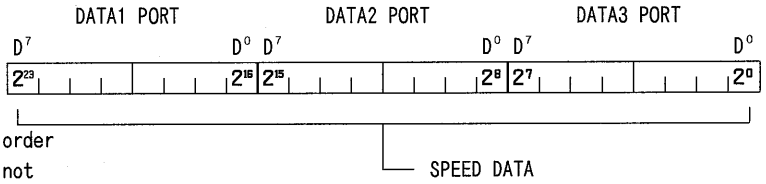
COMMAND····· 66_H Function : To set SCSPD2 necessary for S-RATE DRIVE.

Execution Sequence



Speed is set in DRIVE DATA1 PORT to DRIVE DATA3 PORT in 3-byte data in units of reference clock multiple.

THe contents of DRIVE DATA1 PORT to DRIVE DATA3 PORT are as follows.

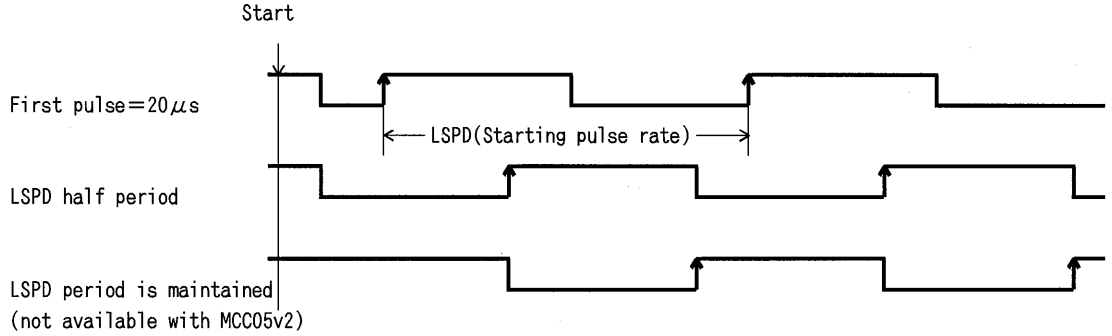


The maximum speed data setting range is from 48(30_H) to 16,777,215($FFFFFF_H$)
However varies with drive type. For the detail, refer to the User's Manual.

7. FIRST OUTPUT PULSE WIDTH SELECTING FUNCTION

It is possible on MCC05v2 to select the first active pulse width after the start of drive out of the half cycle and the fixed periods of 100μs and 20μs in order to shorten the tact time.
For the selection, the SPEC INITIALIZE3 Command is used.
At the time of POWER ON/RESET, the pulse width is set to 100μs.

Explanation : Generally speaking, stepping motor drivers and servo motor drivers run motors at a transition point where input clock changes from active to non-active level (indicated with the arrow in the figure below,"↑").
Thus, in order to cut the tact time, a pulse generator must output the first edge as soon as possible after the start-up command has been issued, irrespective of the level specified for the LSPD (starting pulse rate).



When the LSPD half period is 20μs or above (LSPD is 25 KHz maximum), the drive can be turned earliest if 20μs pulse width selected for the first pulse. See the figure above.
The following table shows an optimum pulse width for each LSPD selected.

LSPD(starting pulse rate)	First pulse to be selected
5KHz maximum	100μs(initial value)/20μs*
5KHz~25KHz	20μs
25KHz minimum	LSPD half period

*Although typical stepping and servo motor drivers accept 20μs with sufficient margin, it is not always so with some drivers. Check specification of a given driver before employing this function.

8. PULSE OUTPUT PATTERN CHANGING FUNCTION

The SPEC INITIALIZE3 Command can change the pulse output pattern to the direction specified output type.
When the direction specified output type is selected, the $\overline{\text{CWP}}$ output terminal of each axis will become the $\overline{\text{POUT}}$ output terminal (pulse output) and the $\overline{\text{CCWP}}$ output terminal will become the $\overline{\text{CWSEL}}$ output terminal (for designating the CW direction in the low level).

When the pulse output pattern is changed, please note that the description in the chapter of "Connection" of the User's Manual does not agree with this change.

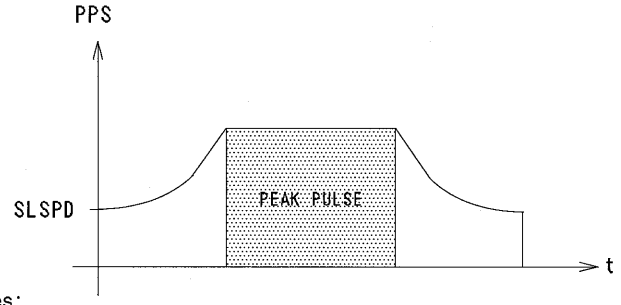
9. TRIANGULAR DRIVE PREVENTION FUNCTION

9-1. Explanation of Function

In order to avoid the triangular drive which starts decelerating without reaching the high speed in the S-RATE INDEX DRIVE due to shortage of pulse number, this function enables to designate the PEAK PULSE number in advance and to secure constant speed operating ranges.

9-2. Specification

When the speed is changed from acceleration to deceleration according to the set PEAK PULSE number, a constant speed range of the PEAK PULSE number is secured.
To designate the PEAK PULSE number, the S-RATE PEAK PULSE SET Command is used.



Notes:

1. The PEAK PULSE is subject to the minimum value limitation if the SHSPD is set. If the set PEAK PULSE is smaller than the minimum value, the minimum value is used as the PEAK PULSE in an actual operation.
   When the set SHSPD data in Hz is F, the minimum PEAK PULSE can be expressed as follows:
   Minimum PEAK PULSE = INT[4800/INT(160,000,000/F)] + 2
   At the time of POWER ON/RESET, the SHSPD is 3000Hz, and the PEAK PULSE comes to 2.
2. When PEAK PULSE + END PULSE (See Chapter 10.) + 1 is larger than the INDEX PULSE number, the constant speed drive of SLSPD will occur. The maximum PEAK PULSE is 65,535.
3. Note that this function will become invalid if a deceleration command is input during acceleration or constant speed.

10. END PULSE DRIVE FUNCTION

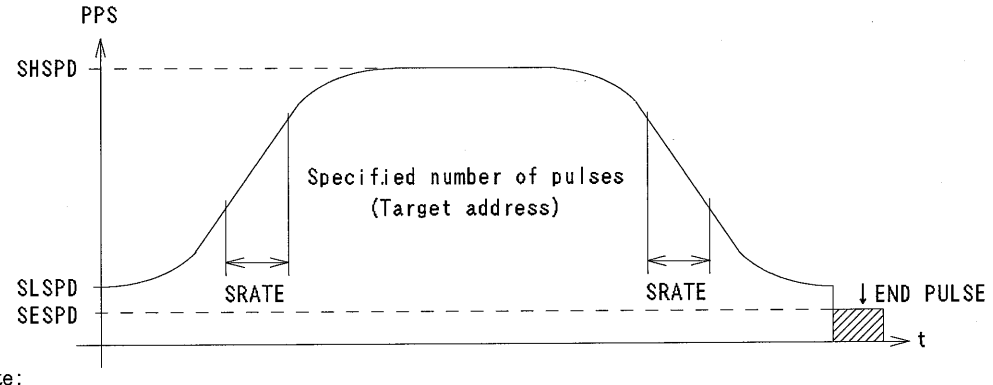
10-1. Explanation of Function

In order to reduce damping at the end of the INDEX DRIVE and S-RATE INDEX DRIVE, this function enables to make a continuous drive of specified frequency and of specified number of pulses after the end of deceleration up to the LOW SPEED.

10-2. Specification

A specified of number of pulses in the total INDEX PULSE number (relative pulse number or pulse number up to the target address) is output as the residual pulse by a specified frequency after the end of a deceleration.
The specified number of pulses (END PULSE or SEND PULSE) is set by the END PULSE SET Command or SEND PULSE SET Command, and the specified frequency (ESPD or SESPD) is set by ESPD SET Command or SESPD SET Command.

Case of S-RATE INDEX DRIVE



Note:

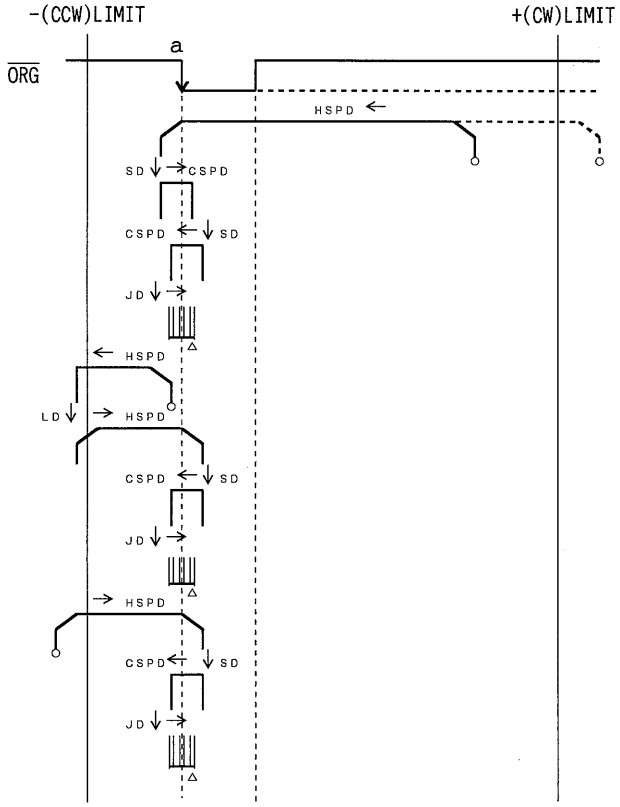
1. The setting range of ESPD is ESPD ≦ LSPD and SESPD is SESPD ≦ SLSPD. If case ESPD>LSPD(or SESPD>SLSPD), ESPD(or SESPD) will become equal to LSPD(or SLSPD).
2. When PEAK PULSE (See Chapter 9.) + END PULSE + 1 is larger than the INDEX PULSE number, a constant speed drive of SLSPD will occur. In addition, the maximum END PULSE is 65,535.
3. Note that this function is invalid during gradual stop by a deceleration command.
4. This function is also invalidated if constant drive results from specifying HSPD≦LSPD and SHSPD≦SLSPD.

11. ORIGIN DRIVE DIRECTION CHANGING FUNCTION

11-1. Explanation of Function

The precondition for origin drive is that the $\overline{\text{ORG}}$ (or $\overline{\text{NORG}}$) sensor has been installed at the -(CCW) limit side along works, but the origin drive direction changing function enables to install the $\overline{\text{ORG}}$ (or $\overline{\text{NORG}}$) sensor on the +(CW) limit side. To change the origin drive direction, the SPEC INITIALIZE4 Command is used. The following shows the detection process of Type ORG-3, and the process is applicable to other types as well. The address in the vicinity of the machine origin is origin - OFFSET PULSE.

11-2. Type ORG-3 fitted with Sensor on -(CCW)LIMIT Side (Initialization)

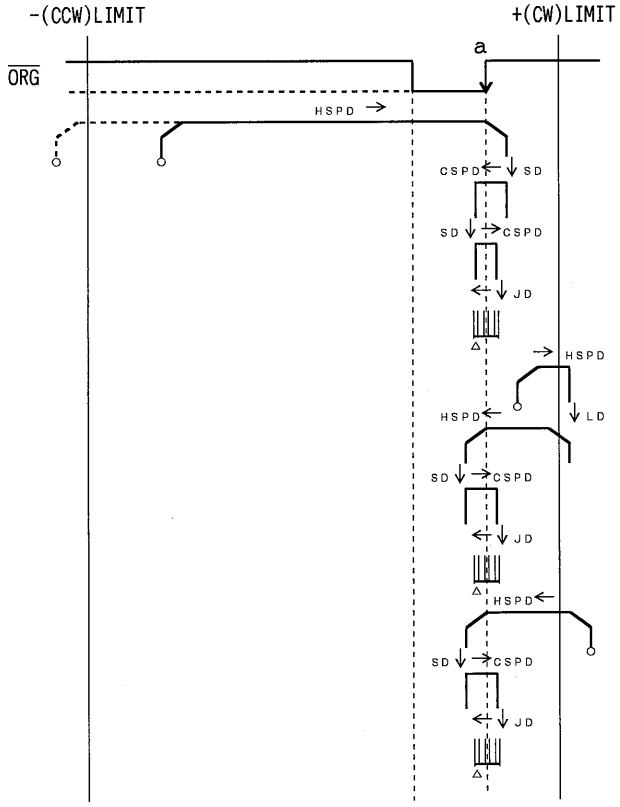


HSPD : HIGH SPEED
CSPD : CONSTANT SPEED
LD : LIMIT DELAY TIME
SD : SCAN DELAY TIME
JD : JOG DELAY TIME
○ : Detection start position
△ : Detection end position

The -(CCW) side edge (Point "a") of $\overline{\text{ORG}}$ signal is detected.

Use an ORG sensor for 1 pulse or retaining the +(CW) side level.

11-3. Type ORG-3 fitted with Sensor on +(CW)LIMIT Side (The Origin Drive Direction Changing Function is used.)



HSPD : HIGH SPEED
CSPD : CONSTANT SPEED
LD : LIMIT DELAY TIME
SD : SCAN DELAY TIME
JD : JOG DELAY TIME
○ : Detection start position
△ : Detection end position

The +(CW) side edge (Point "a") of $\overline{\text{ORG}}$ signal is detected.

Use an ORG sensor for 1 pulse or retaining the -(CCW) side level.

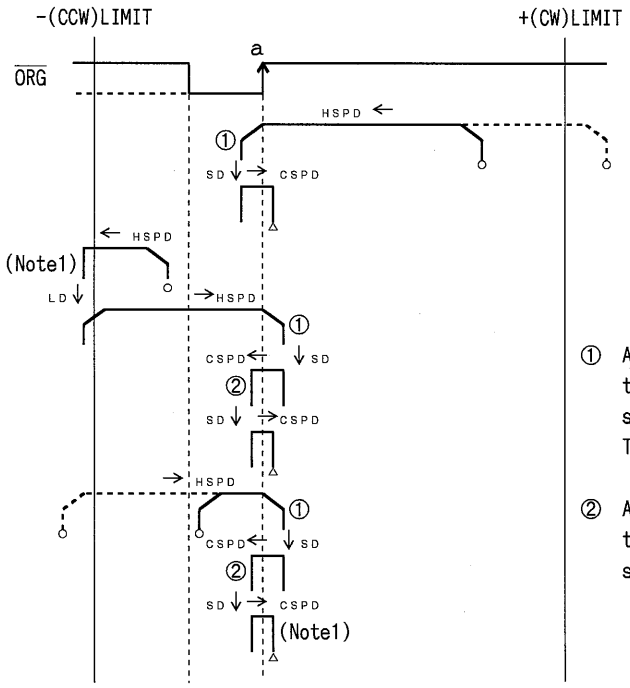
12. MARGIN TIME FUNCTION

12-1. Explanation of Function

This is a function to insert a MARGIN TIME (delay time) from sensor signal detection to PULSE stop when the ORIGIN DRIVE is executed. When the MARGIN TIME is inserted, overshoots from the sensor signal detecting position can be adjusted and malfunctions due to hunting can be prevented.
The MARGIN TIME is set in units of 0.2ms in the range from 0 to 51ms.
MARGIN TIME is 0 at POWER ON/RESET.

12-2. MARGIN TIME Inserting Process

(1) Example of Type ORG-0



HSPD : HIGH SPEED
CSPD : CONSTANT SPEED
LD : LIMIT DELAY TIME
SD : SCAN DELAY TIME
○ : Detection start position
△ : Detection end position

① After the end of deceleration up to the LSPD to be detected with the ORG sensor, the constant speed drive of the LSPD will occur for the MARGIN TIME and will stop.

② After detection with the ORG sensor, the MARGIN TIME will be secured and the drive will stop.

Note1: The MARGIN TIME cannot be inserted when the drive comes to a limit or during the final process.
Note2: No MARGIN TIME can be inserted during the constant speed drive immediately before the NEAR ORG process changes to the ORG process in the ORG-4,5 processes.

13. SOFT LIMIT FUNCTION

13-1. Explanation of Function

⚠ CAUTION

If there is any error or incorrect setting, the machine or parts may be damaged.
For the equipment other than that of the rotation system, be sure to use the LIMIT STOP function.
Do not use the SOFT LIMIT as final system protective function.

A value set by the CW or CCW SOFT LIMIT Command can be used as the SOFT LIMIT.
Use the SPEC INITIALIZE4 Command for selecting the SOFT LIMIT function.

13-2. Specification

(1) A drive may not be turned on or the turned on drive may stop at the SOFT LIMIT position depending on the drive type and address of the current position.

a. You cannot turn on an INDEX DRIVE that is set to operate beyond the SOFT LIMIT value. Nor, you can start the JOG or SCAN DRIVE that is set to operate beyond the SOFT LIMIT value at the SOFT LIMIT position.
In such case, DREND, ERROR and LSEND bits on the STATUS1 PORT are turned on (STATUS1=$2C_H$).
And, one of the CW or CCW SOFT LIMIT bit is turned on, too.
However, when you started an INDEX DRIVE with 0 pulse number at the SOFT LIMIT position, the ERROR bit will not be turned on.

b. A JOG or SCAN DRIVE started from any position other than the SOFT LIMIT position will be continued up to the SOFT LIMIT position. As for an acceleration/deceleration drive, its drive speed will be decelerated so that it may stop at the SOFT LIMIT position (a SCAN DRIVE will be switched to an INDEX DRIVE up to the SOFT LIMIT position).
In this case, DEND and LSEND bits on the STATUS1 PORT are turned on (STATUS=24_H). And, one of the CW or CCW SOFT LIMIT bit on the STATUS5 PORT is turned on, too.
Note that you may not be able to distinguish the SOFT LIMIT stop from a usual LIMIT stop from the STATUS1 PORT alone. You should also refer to the STATUS5 PORT, as needed.

c. A SENSOR INDEX3 DRIVE may or may not be turned on depending on the address of current position and specified pulse number. If ABS(SOFT LIMIT address minus current position address) is smaller than the specified pulse number, the drive cannot be started.
* ABS( ) is represented in an absolute value.
If the sensor input is absent, the drive comes to stop at the SOFT LIMIT address (the same applies to the SENSOR INDEX1 DRIVE).
The status described in Section "a" and "b" above applies to each case in this drive.

(2) The SOFT LIMIT function is not available for the ORIGIN DRIVE alone.
The CW and CCW SOFT LIMIT bits on the STATUS5 port after ORIGIN DRIVE are in undefined and not guaranteed.

(3) As long as the SOFT LIMIT function is used, the SPECIAL SCAN1 and 2 DRIVE with URATE≠DRATE is inoperable.
Trying to use this drive will result in an error.

(4) You should not try to change a speed of the SCAN DRIVE whose URATE is not equal with the DRATE.
Otherwise, troubles can result including the one in which the drive is stopped instantaneously without going through the LSPD stage or the one in which the drive is continued over a long period at the LSPD.
Same result occur to use rate change. (see Note2 in Section 3-11.).

(5) Current SOFT LIMIT ADDRESS is valid until it is reset or the SOFT LIMIT SET Command is executed again.
Note that current SOFT LIMIT ADDRESS remains valid after the address of current position has been changed with the ADDRESS INITIALIZE Command. Thus, any drive that requires another SOFT LIMIT ADDRESS may not be carried out as long as current ADDRESS is valid.

(6) Additional Explanation on the Status

When the SOFT LIMIT is selected, LSEND and ERROR bits on the STATUS1 PORT are turned on if the following condition is met:

*LSEND

When a drive is located at the LOFT LIMIT ADDRESS after the operation.

An INDEX DRIVE with 0 pulse number is also included in this case. This applies to the stop made by the normally used CWLM or CCWLM input, too.

*ERROR

When a drive hat not been turned on with the SOFT LIMIT.

14. ASYMMETRIC S-RATE DRIVE FUNCTION

SRATE in the acceleration and deceleration modes can be specified individually. This function cannot be used in combination with triangular drive workaround function discussed in the next Chapter. It can be used in combination with triangular drive prevention function (PEAK PULSE).
(While this function is enabled, triangular drive workaround function is disabled unconditionally).
Furthermore, when this function is enabled, INDEX CHANGE cannot be executed.

Whether this function is used or not is determined by the SPEC INITIALIZE5 command.
When this function is enabled, the following command specifications are different from ordinary ones. For details, refer to "14-2 Command".

SRATE SET COMMAND
SSRATE ADJUST COMMAND
SERATE ADJUST COMMAND

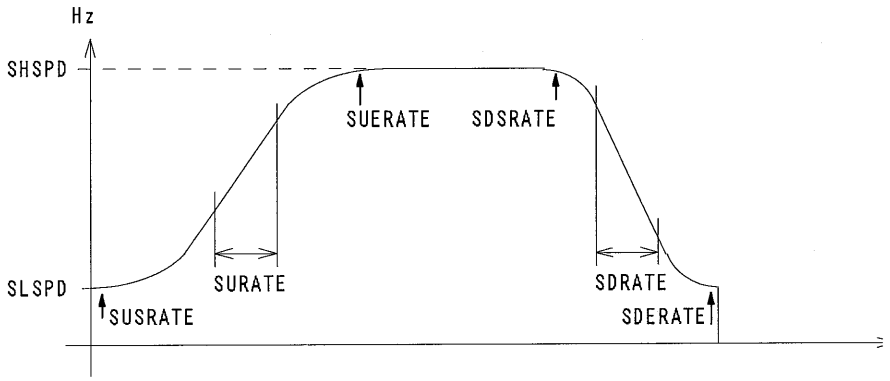
If this function is enabled, the SRATE DOWN POINT SET command must be executed once before execution of S-RATE INDEX DRIVE, after execution of any one (or multiple) of the following commands. If this is not executed, COMMAND ERROR (CODE=OC_H) occurs without driving.

1. SPEC INITIALIZE1 COMMAND
2. RESOLUTION SET COMMAND
3. SRATE SET COMMAND
4. SSRATE ADJUST COMMAND
5. SERATE ADJUST COMMAND
6. SLSPD SET COMMAND
7. SHSPD SET COMMAND
8. SCSPD1 ADJUST COMMAND
9. SCSPD2 ADJUST COMMAND

Once SRATE DOWN POINT SET command has been executed, it does not need to be set again unless the above-mentioned command is executed again.

14-1 Asymmetric S-RATE DRIVE acceleration/deceleration parameter

The following shows the S-RATE DRIVE acceleration/deceleration parameter when the asymmetric S-RATE DRIVE function is enabled.



Data names	Setting command
URATE (time constant of straight line portion in S-RATE DRIVE acceleration)	SRATE SET
SDRATE (time constant of straight line portion in S-RATE DRIVE deceleration)	SRATE SET
SUSRATE (time constant at the start of S-RATE DRIVE acceleration)	SSRATE ADJUST
SUERATE (time constant at the end of S-RATE DRIVE acceleration)	SERATE ADJUST
SDSRATE (time constant at the start of S-RATE DRIVE deceleration)	SSRATE ADJUST
SDERATE (time constant at the end of S-RATE DRIVE deceleration)	SERATE ADJUST

14-2. SRATE SET COMMAND when asymmetric S-RATE DRIVE is enabled

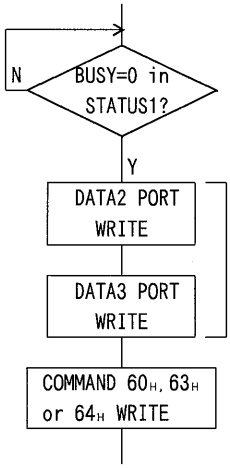
COMMAND····· 60_H SRATE SET Function : Set up the SURATE and SDRATE.

COMMAND····· 63_H SSRATE ADJUST Function : Set up the SUSRATE and SDSRATE

COMMAND····· 64_H SERATE ADJUST Function : Set up the SUERATE and SDERATE.

(1) Fixed mode

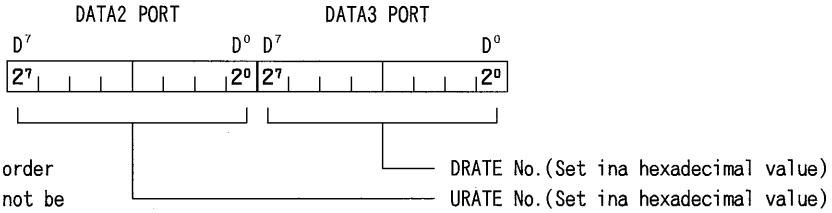
Execution sequence



The order may not be observed.

Set the time constant at the time of acceleration to the DRIVE DATE2 port, and the time constant at the time of deceleration to the DRIVE DATE3 port according to the DATA.

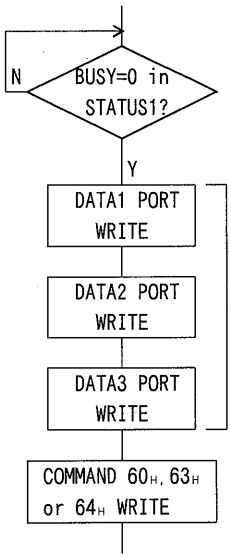
The contents of the DRIVE DATA1 PORT to DRIVE DATA3 PORT are as follows.



* When you want to change the DATA of either acceleration or deceleration, set the unchanged DATA to FFH. In this case, the previous DATA will be used. Especially after automatic setting of the SSRATE/SERATE, the DATA is not clear to the user. So if you want to change one of the DATA, you can use this function effectively.

(2) Arithmetic mode

Execution sequence

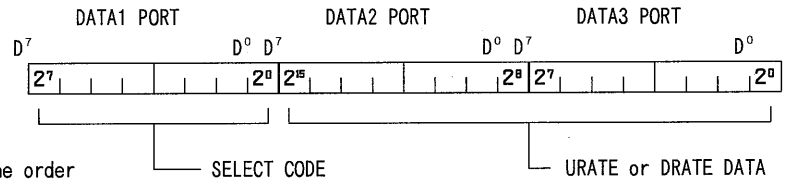


The order may not be observed.

Set the time constant at the time of acceleration or deceleration to the DRIVE DATE 2 and 3 ports using two-byte data.

DRIVE DATA1 PORT specifies which of acceleration or deceleration is to be set.

The contents of the DRIVE DATA1 PORT to DRIVE DATA3 PORT are as follows.



The RATE DATA setting range is 64 (40H) to 65,535 (FFFFH).
The following shows the function of the SELECT CODE:

CODE	FUNCTION
00_H	URATE SET
01_H	DRATE SET
02_H	URATE, DRATE are set at the same time.
except above	COMMAND ERROR

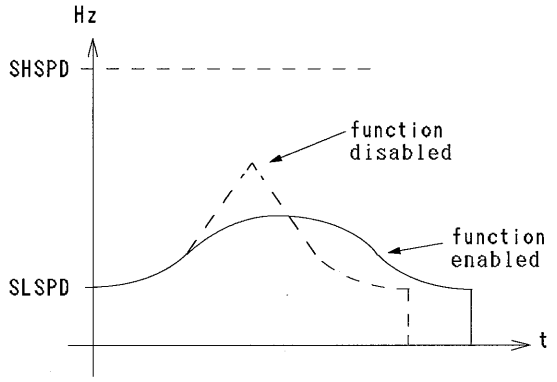
Note 1: If the SRATE SET command is executed, the SUSRATE/SUERATE/SDSRATE/SDERATE adjusted before execution will be disabled, and value is reset to the initial value.
The same applies when the DRIVE TYPE is set by SPEC INITIALIZE command.

Note 2: SUSRATE adjustment range is SUSRATE ≧ SURATE. Outside the range, SUSRATE = SURATE.
SUERATE adjustment range is SUERATE ≧ SURATE. Outside the range, SUERATE = SURATE.
SDSRATE adjustment range is SDSRATE ≧ SDRATE. Outside the range, SDSRATE = SDRATE.
SDERATE adjustment range is SDERATE ≧ SDRATE. Outside the range, SDERATE = SDRATE.

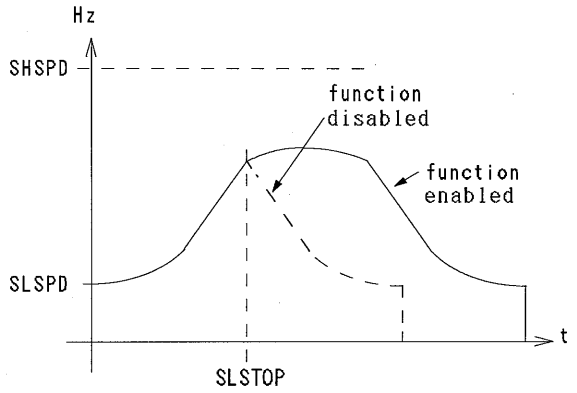
15. S-RATE DRIVE TRIANGULAR DRIVE WORKAROUND FUNCTION

This is a function to workaround triangular drive when the number of pulses is small in the S-RATE INDEX DRIVE. If the number of remaining pulses is smaller than the specified number of pulses, the RATE is made reduced automatically, and the TOP SPEED section is made round. To distinguish it from the triangular drive by PEAK PULSE in Chapter 9, the latter is called "triangular drive preventive function", while the function in the present Chapter is called "triangular drive workaround function". They can be used in combination.
Furthermore, when this function is enabled and you want to perform deceleration in the SLSTOP mode, you can select the operation with triangular drive workaround function taken into account.

Triangular drive workaround function



Slow stop function with triangular drive workaround function taken into account



Whether this function is used or not is determined by the SPEC INITIALIZE5 command.

Note 1: If the INDEX CHANGE is executed after the DRIVE profile is changed by this function, the operated is restart after completion of the DRIVE by the initial DATA.
Note 2: If the asymmetric S-RATE DRIVE is enabled, this function does not work.

16. AUTO CHANGE FUNCTION

If the change point set up in the INDEX or SCAN DRIVE mode has been passe by, this function automatically performs operation to change to the preset DATA. Use the special-purpose data to set the change point and change data in advance.

The change point can be specified by specifying the number of the output pulses, output speed or time. When you want to use the output speed, you must set either the speed passed by in acceleration or the speed passed by in deceleration.
As the data to be changed, you can specify SPEED and RATE (only in SCAN DRIVE mode).
You can specify a total of 32 points of change. Points of change are numbered from 0 to 31. Change operation is performed according to these numbers.

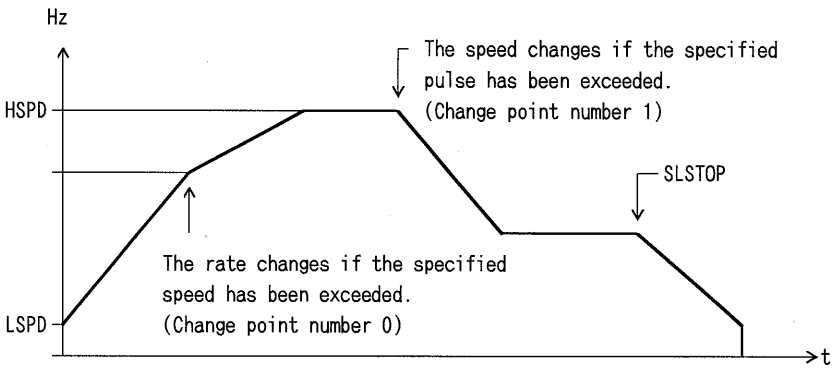
This function is similar to the SERIAL INDEX DRIVE function, but is more versatile. Stop in the LSPD mode is also guaranteed. However, LSPD may not be guaranteed in the SCAN DRIVE when the SIFT LIMIT is enabled. (Refer to the description of 3-12 and 13-2(4)).
Combined use with the SPEED/INDEX/RATE CHANGE function by the AUTO CHANGE and CHANGE command is also possible.

Change point data (pulse, speed or time), change data (speed or rate) and change operation can specified by the following commands. These commands must be used on the continuous basis.

CHANGE POINT SET ... Sets the change point data.
CHANGE DATA SET .... Sets the change data.
AUTO CHANGE SET .... Specifies the change operation.
(The data set by the CHANGE POINT SET and CHANGE DATA SET is set at the storage area at a specified change point number. The data type is also set).

Whether this function is used or not is determined by the SPEC INITIALIZE5 command.

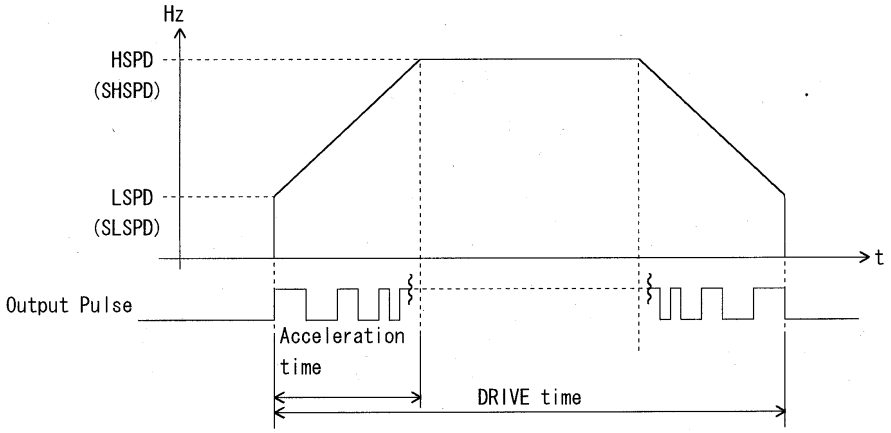
Operation example



Note: Normally the change point is not checked. It is checked only once for each rate cycle. So the drive state is changed a little later than the specified change point.
(For RATE cycle, Refer to the description of 5-4.).

17. DRIVE CALCULATION FUNCTION R5

This simulation function calculates the number of pulses required to increase the speed from LSPD(SLSPD) to HSPD(SHSPD) or acceleration time, and the INCREMENTAL INDEX DRIVE drive time (time from the start of PULSE out put to the end of final pulse).



* Calculates any one of the acceleration time, the number of acceleration pulses and drive time indicated by the above drive pattern chart.

17-1. Execution command

The DRIVE calculation function is performed by the DRIVE CALCULATE command or SRATE DRIVE CALCULATE command.

The DRIVE CALCULATE command performs the SCAN DRIVE or INDEX DRIVE (for the NORMAL RATE). The SRATE DRIVE CALCULATE command calculates the S-shaped RATE SCAN DRIVE or INDEX DRIVE. Each command carries out simulated calculation of the specified data according to the following DRIVE parameter preset immediately before the execution of the command, and outputs the results in terms of 3-byte data.

- Normal RATE DRIVE parameter
  DRIVE-TYPE(or RESOLUTION), URATE, DRATE, LSPD, HSPD, END PULSE, ESPD and first pulse width)
- S-shaped RATE DRIVE parameter
  DRIVE-TYPE (or RESOLUTION), SRATE, SLSPD, SHSPD, SCSPD1, SCSPD2, SSRATE, SERATE, SEND PULSE, SESPD, PEAK PULSE and first pulse width
  (When asymmetric S-RATE DRIVE function and triangular drive workaround function are enabled, these conditions are taken into account).

Which of the acceleration time, number of acceleration pulses and drive time is to be calculated is specified by the values of DATA1 PORT to DATA 3 PORT given at the time of command execution.

0 ..... Calculates the number of pulses.
1 ..... Calculates the acceleration time.
2 to 8,388,607 ... Calculates the DRIVE time. In this case, the preset data is calculated as output pulse.

17-2. The result of calculation

For the number of acceleration pulses, the result of calculation is output within the range from 2 to 8,388,607 pulses in increments of one pulse. If the result exceeds 8,388,608 pulses, overflow occurs and "0" is output.

For acceleration time or drive time, the result is output within the range from 1 to 214,747 ms in increments of 1ms. If the result exceeds 214,748 ms, overflow occurs and "0" is output. It should be noted that a fraction less than 1 ms is discarded entirely. Furthermore, when DRIVE time is calculated and the DRIVE is calculated to turn into triangular drive (without reaching HSPD or SHSPD), the flag bit showing this is turned on. Similarly, if the DRIVE is considered to reach a constant speed, the flag bit showing this is turned on.

17-3. Calculation accuracy

Tolerance for the result of calculating the number of acceleration pulses is within ± 1 pulse.
Tolerance for the result of calculating the acceleration time is within the range from -0 to +2 ms.
Tolerance for the result of calculating the DRIVE time is within the range from -0 to +2 ms except for the following cases:

- If the number of output pulses specified does not exceed 200, accurate calculation cannot be made partly.
- When the triangular drive workaround function is enabled in S-RATE DRIVE mode, there is a maximum error of about 2 percent between the theoretical value and actual DRIVE.
- It may become the wrong calculation, if S-RATE DRIVE calculation is carried out after performing operation which a triangular drive evasion function commits.

18. OTHER FUNCTIONS

18-1. DEND ERROR Detection

(1) Explanation of Function

When SERVO is specified for the motor type, every drive does not come to stop until active level is acknowledged of $\overline{\text{DEND}}$ signal from the servo driver that is turned on as the pulse output is complete (BUSY BIT on STATUS1 is not returned to 0).
Thus, if $\overline{\text{DEND}}$ signal does not return on some reasons, current drive is continued rejecting any try for the control. (With the initial specification, RESET alone can stop the drive.)
This DEND ERROR detect function is intended for stopping such drive forcibly as an error.

(2) Specification

If the active level of $\overline{\text{DEND}}$ signal is not returned within the predetermined time period, the drive is forcibly stopped with the STATUS1 PORT ERROR BIT being set to 1.
The time to wait for $\overline{\text{DEND}}$ signal to return that follows the pulse output can be set in the range from 5 ms to 327,674 seconds. This function can be selected with the SPEC INITIALIZE4 Command.
And $\overline{\text{DEND}}$ wait time can be set with the DEND TIME SET Command.

18-2. ORIGIN SENSOR Type select

(1) Explanation of Function

MCC05v2 machine origin detect function normally performs its task by latching active edge of ORG sensor. This specification, however, can degrade accuracy by 1 to several pulses in the mechanical system where significant damping occurs during the JOG DRIVE process.
This accuracy loss results if the sensor is momentarily activated by damping-dependent overshoot of the nearby mechanical system (the mechanical system has not yet reached the sensor).
The SENSOR TYPE SELECT function is intended to maintain accrue of the origin detect function on the mechanical system. In the JOG DRIVE process, this function allows you to carry out the detect using active level of the ORG sensor. An optimum detect accuracy can be ensured by selecting the level for the SENSOR TYPE and selecting a JOG DELAY TIME longer than the damping duration.
The EXTEND ORIGIN SPEC SET Command is used for selecting this function.

(2) Precautions

In the active level detection approach, MCC05v2 may overlook the ORG sensor if the signal width from source is the same or less than 1 pulse resolution. An example of this case is Z phase signal of the encoder (it can increase risk since servo motors can be vibrating with ±1 pulse or more even after it has been stopped). This overlook results because the MCC05v2 is designed to check the ORG only once for every JOG DELAY both for the edge and level detection approach. So, if the ORG sensor is not active when checked, it proceeds to the succeeding process to output another JOG PULSE. In the edge detection approach, this risk is prevented because latched signals are checked in this method.
Therefore, before selecting the level detect approach, you should study active level output performance of the ORG sensor, behavior of the mechanical system and the ORG sensor detection specification of the MCC05v2.

18-3. ORIGIN ERROR Detection

(1) Explanation of Function

If the ORG signal is not detected at the machine origin, the drive is stopped upon entry of either the CW or CCW LIMIT. Such trouble in the CONSTANT SCAN DRIVE or JOG DRIVE takes a fairly large amount of time until the drive comes to stop at the LIMIT, thus delaying abnormality processing of the system.
This ORIGIN ERROR DETECT function can stop a drive as an error if the MCC05v2 fails to detect the sensor with in the range of the predetermined maximum pulse number. When the system adjustment is complete, pulse number to be output in the CONSTANT SCAN DRIVE and JOG DRIVE processes does not significantly vary. If you set the maximum pulse referencing these pulse numbers, useless efforts of the system can be prevented when a trouble occurred.

(2) Specification

If active level of the sensor is not found within the specified pulse number, this function sets the ERROR BIT in STATUS1 PORT to 1 and, thus, forcibly stops the ORIGIN DRIVE.
The maximum pulse number for the CONSTANT SCAN DRIVE can be specified in the range from 1 to 8,388,607 and that for the JOG DRIVE can be specified in the range from 1 to 256.
EXTEND ORIGIN SPEC SET Command is used for selecting this function and setting the maximum pulse number.
The maximum pulse number for CONSTANT SCAN DRIVE can be specified by CONSTANT SCAN MAX PULSE SET Command.

(3) Precautions

Note that modifying drive parameters such as LSPD, HSPD, CSPD and RATE after the system adjustment also changes the pulse number required for the CONSTANT SCAN DRIVE process.

18-4. AUTO DRST Output

When SERVO is selected for the motor type, machine origin detect accuracy can be affected by gain on an servo motor. This accuracy loss occurs because the motor is run by the pulses remained on the DIFFERENTIAL COUNTER(of servo driver) after the MCC05v2 has detected the origin sensor and, accordingly, stopped the pulse output.

Effects of the gain is considered to be significant for an ORG type where the final process ends with the CONSTANT SCAN. The AUTO DRST OUTPUT function is designed to correct such trouble. If this function is properly set, the MCC05v2 stops pulse output as it detects the origin sensor and, at the same time, resets the servo driver DIFFERENTIAL COUNTER sending $\overline{\text{DRST}}$ signal for 10 ms.

As long as this function is valid, $\overline{\text{DEND}}$ signal is not checked in the JOG DRIVE and final CONSTANT SCAN processes. The EXTEND ORIGIN SPEC SET Command is used for turning this function on.

18-5. PO Input

Using PO (excitation) output signal from the ORG sensor and the stepping motor driver, this function offers the origin detection with higher accuracy. This function is available for ORG 4 and 5.

Your setting should such that PO signal comes within the active level of the ORG signal for one time.

When this function is turned on, logical product (AND) of the ORG signal and PO signal is processed as the ORG signal. The EXTEND ORIGIN SPEC SET Command is used for selecting this function.

Note: Don't try to use this function for the ORG-0 to 3 and 10 to 12.

18-6. SPECIAL DRST Output

(1) Explanation of Function

The SERVO RESET Command prepared as a basic function to output the $\overline{\text{DRST}}$ signal is not available when the MCC05v2 is busy. Having the same function as that of the SERVO RESET Command, this SPECIAL DRST OUTPUT is included in the group of special commands that does not require to check if the MCC05v2 BUSY=0 or not.

This function allows you to turn the $\overline{\text{DRST}}$ output active (LOW) for 10 ms using the DRST OUT Command.

This command has the same function as that of the SERVO RESET Command except that it is available any time.

This command is also valid when STEPPING is selected for the motor type.

(2) Precautions

The DRST OUT Command is designed to function as a trigger so that the output may continue for 10 ms since it is executed the last time, thus you can extend the output duration to more than 10 ms by entering this command consecutively.

18-7. GENERAL PURPOSE Input/Output

When a stepping motor is selected for the motor type, the $\overline{\text{DRST}}$ output is not used. In this case, the $\overline{\text{DRST}}$ signal is used as the general purpose output. This function is turned on or off with the SIGNAL OUT Command. This SIGNAL OUT Command is usable any time irrespective of the motor type specified.

The $\overline{\text{DEND}}$ input is also not used for stepping motors, but this input can be utilized as general purpose input since it can be read any time from the STATUS2 PORT. It should be noted, however, that the $\overline{\text{DEND}}$ input is also used as a $\overline{\text{PO}}$ input, so it cannot be used as a general purpose input if the $\overline{\text{PO}}$ input is used.

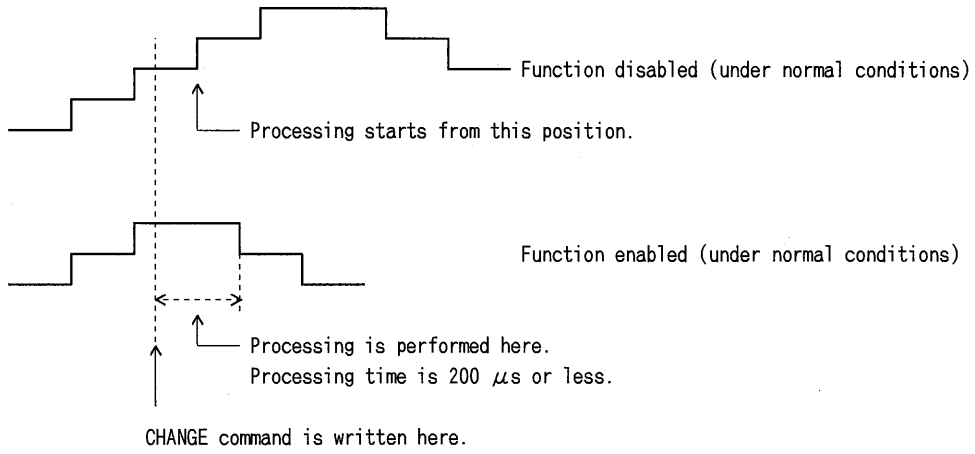
You CANNOT use DRSTCOM with this function.

18-8. SPEED/RATE CHANGE speed increase

In the SPEED/RATE CHANGE during normal SCAN DRIVE, processing is provided to guarantee LSPD, similarly to the case of INDEX DRIVE, so CHANGE timing must come after the RATE cycle. (For the RATE cycle, Refer to the description of 5-4).

For the reason of processing, several RATE cycles are necessary after the CHANGE command is written. Since it is not necessary to guarantee the LSPD in the SCAN DRIVE mode, the speed can be increased. This function confirms the SPEED/RATE CHANGE during the operation at all times and performs CHANGE processing when it has been written.

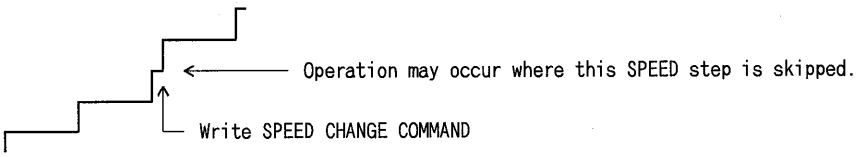
Example of SPEED CHANGE (from acceleration to deceleration)



Whether this function is used or not is determined by the SPEC INITIALIZE5 command.

Note 1: When this function and SOFT LIMIT are used in combination and the operation is stopped by the SOFT LIMIT ADDRESS, the following problem occurs:
It is immediately stopped at the speed higher than LSPD, or DRIVE is performed at LSPD for a long time.

Note 2: CHANGE operation is started immediately after CHANGE command is written. So depending on the time when the command is written, operation may occur where a SPEED step is skipped.



19. DESCRIPTION OF APPLIED FUNCTION DRIVE COMMANDS AND OPERATION SEQUENCE

19-1. Applied Function Drive Command Table(The mark * denotes a command accompanied by pulse output.)

	$D^7D^6D^5D^4D^3D^2D^1D^0$	HEX CODE	COMMAND NAME	Execution time
	0 0 0 0 1 0 0 1	0 9	DFL COUNTER INITIALIZE	MAX 25μs
	0 0 0 0 1 0 1 1	0 B	CW SOFT LIMIT	MAX 25μs
	0 0 0 0 1 1 0 0	0 C	CCW SOFT LIMIT	MAX 25μs
	0 0 0 0 1 1 0 1	0 D	Setting is disabled.	————
	0 0 0 0 1 1 1 0	0 E	DFL DIVISION DATA SET	MAX 25μs
	0 0 0 0 1 1 1 1	0 F	SENSOR INDEX3 DATA SET	(Note1)
	0 0 0 1 1 0 0 0	1 8	END PULSE SET	MAX 20μs
	0 0 0 1 1 0 0 1	1 9	ESPD SET	MAX 55μs
	0 0 1 0 0 0 0 0	2 0	SPEC INITIALIZE3	MAX 30μs
	0 0 1 0 0 0 0 1	2 1	Setting is disabled.	————
	0 0 1 0 0 0 1 0	2 2	RESOLUTION SET	(Note1)
	0 0 1 0 0 0 1 1	2 3	PART HSPD BUFFER SET	MAX 85μs
	0 0 1 0 0 1 0 0	2 4	PART HSPD SET	MAX 140μs
	0 0 1 0 0 1 0 1	2 5	INCREMENTAL DATA SET	MAX 25μs
	0 0 1 0 0 1 1 0	2 6	ABSOLUTE DATA SET	MAX 25μs
	0 0 1 0 0 1 1 1	2 7	PART PULSE SET	MAX 180μs
	0 0 1 0 1 0 0 0	2 8	SERIAL INDEX CHECK	(Note1)
	0 0 1 0 1 0 0 1	2 9	PART RATE SET	MAX 30μs
	0 0 1 0 1 0 1 0	2 A	SPECIAL SERIAL INDEX CHECK	(Note1)
	0 0 1 0 1 0 1 1	2 B	MARGIN TIME SET	MAX 20μs
	0 0 1 0 1 1 0 0	2 C	PEAK PULSE SET	MAX 25μs
	0 0 1 0 1 1 0 1	2 D	SEND PULSE SET	MAX 25μs
	0 0 1 0 1 1 1 0	2 E	SESPD SET	MAX 50μs
	0 0 1 0 1 1 1 1	2 F	SPEC INITIALIZE4	MAX 65μs
*	0 0 1 1 0 0 0 0	3 0	+SPECIAL SCAN1	(Note2)
*	0 0 1 1 0 0 0 1	3 1	-SPECIAL SCAN1	(Note2)
*	0 0 1 1 0 0 1 0	3 2	+SPECIAL SCAN2	(Note2)
*	0 0 1 1 0 0 1 1	3 3	-SPECIAL SCAN2	(Note2)
*	0 0 1 1 0 1 0 0	3 4	SPECIAL INCREMENTAL INDEX1	(Note2)
*	0 0 1 1 0 1 0 1	3 5	SPECIAL ABSOLUTE INDEX1	(Note2)
*	0 0 1 1 0 1 1 0	3 6	SPECIAL INCREMENTAL INDEX2	(Note2)
*	0 0 1 1 0 1 1 1	3 7	SPECIAL ABSOLUTE INDEX2	(Note2)
*	0 0 1 1 1 0 0 0	3 8	+SERIAL INDEX	(Note2)
*	0 0 1 1 1 0 0 1	3 9	-SERIAL INDEX	(Note2)
*	0 0 1 1 1 0 1 0	3 A	+SPECIAL SERIAL INDEX	(Note2)
*	0 0 1 1 1 0 1 1	3 B	-SPECIAL SERIAL INDEX	(Note2)
*	0 0 1 1 1 1 0 0	3 C	SENSOR INDEX1	(Note2)
*	0 0 1 1 1 1 0 1	3 D	SENSOR INDEX2	(Note2)
*	0 0 1 1 1 1 1 0	3 E	SENSOR INDEX3	(Note2)
*	0 1 0 0 0 0 0 0	4 0	+SENSOR SCAN1	(Note2)
*	0 1 0 0 0 0 0 1	4 1	-SENSOR SCAN1	(Note2)
		4 2～4 F	Setting is disabled.	————
	0 1 0 1 0 0 0 0	5 0	DEND TIME SET	MAX 25μs
	0 1 0 1 0 0 0 1	5 1	EXTEND ORIGIN SPEC SET	MAX 25μs
	0 1 0 1 0 0 1 0	5 2	CONSTANT SCAN MAX PULSE SET	MAX 25μs
	0 1 0 1 0 0 1 1	5 3	CHANGE POINT SET	MAX 25μs
	0 1 0 1 0 1 0 0	5 4	CHANGE DATA SET	MAX 25μs
	0 1 0 1 0 1 0 1	5 5	AUTO CHANGE SET	MAX 45μs
		5 6～5 E	Setting is disabled.	————
	0 1 0 1 1 1 1 1	5 F	SPEC INITIALIZE5	MAX 30μs
	0 1 1 0 1 1 1 1	6 F	SRATE DOWN POINT SET	(Note3)
	1 1 0 1 0 0 0 0	D 0	DRIVE CALCULATE	(Note3)
	1 1 0 1 0 0 0 1	D 1	SRATE DRIVE CALCULATE	(Note3)

Note1: The execution time varies with drive type. See Chapter 16.
Note2: The execution time cannot be specified. Refer to Chapter 18. Timing.
Note3: Differs according to the DRIVE type. Refer to the description of Chapter 21.
Note4: For A-LINK, add 0.3 ms to the execution time(for 625000 bps).

19-2. Special Command Table

Special commands can always be executed, except just behind not Special command executed in less than 4μs.

$D^7D^6D^5D^4D^3D^2D^1D^0$	HEX CODE	COMMAND NAME	Execution time
1 1 1 1 0 0 1 0	F 2	GPIO DIRECTION SET	MAX 200ns
1 1 1 1 0 0 1 1	F 3	SIGNAL OUT	MAX 200ns
1 1 1 1 0 1 0 0	F 4	INDEX CHANGE	(Note1)
1 1 1 1 0 1 0 1	F 5	RATE CHANGE	(Note1)
1 1 1 1 0 1 1 0	F 6	DRST OUT	MAX 200ns

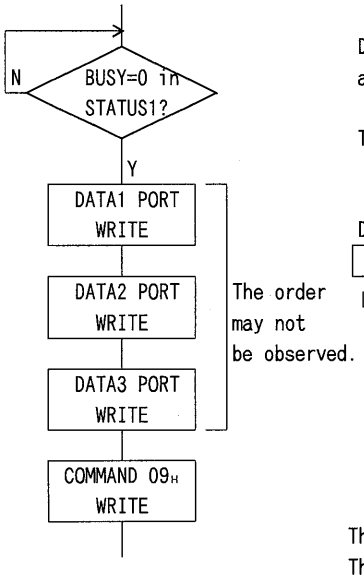
Note1: The execution time cannot be specified. Refer to Chapter 18. Timing.

19-3. DFL COUNTER INITIALIZE Command

COMMAND····· 09_H

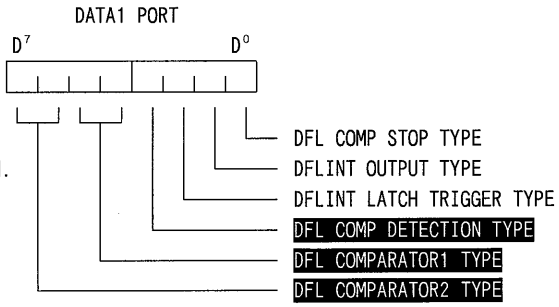
Function : Sets up the DIFFERENTIAL COUNTER performance specification. The portion indicated by highlighted character corresponds to application functions.

Execution sequence



DIFFERENTIAL COUNTER specifications are defined in DRIVE DATA1, DRIVE DATA2 and DRIVE DATA3 PORT.

The contents of DRIVE DATA1 PORT are as follows.



The details of each bit of the DRIVE DATA1 PORT are as follows.
The bit is set to the underlined side at POWER ON/RESET.

(1) DFL COMP STOP TYPE (D^0)

When the "Stop" is selected for the COMP STOP ENABLE on the DIFFERENTIAL COUNTER, this bit is used for specifying either the immediate stop or the stop through deceleration (the same specification applies to the COMPARATOR1 and 2).

0: Immediate stop 1: Stop through deceleration

(2) DFLINT OUTPUT TYPE (D^1)

This bit is used for selecting the DFLINT output specification on the DIFFERENTIAL COUNTER. (the same specification applies to the COMPARATOR1 and 2).

0: Latches and then outputs the detection done by the comparators. (STATUS3 READ is used for resetting the latch)

1: Outputs the detection done by the comparators as is without latching them.

Note: Selecting 1 outputs the detection done by the comparators as is, so the STATUS3 READ may not be used for resetting this mode.

(3) DFLINT LATCH TRIGGER TYPE (D^2)

When "Latch" is selected for the DFLINT output specification on the DIFFERENTIAL COUNTER, this bit is used for specifying type of the latch (the same specification applies to the COMPARATOR1 and 2).

0: Level latch
(Executing the STATUS3 READ while the detecting condition are met does not change the DFLINT output, namely it remains active.)

1: Edge latch
(Executing the STATUS3 READ while the detecting conditions are met resets the DFLINT output.)

Note: When "Latch" is not specified for the DFLINT output, the operation is not affected by this bit.

(4) DFL COMP DETECTION TYPE (D^3)

This bit is used for specifying which of the detection type, detection of absolute value or signed value, is to be employed for the DIFFERENTIAL COUNTER comparators.

0: Detection in absolute value 1: Detection in signed value

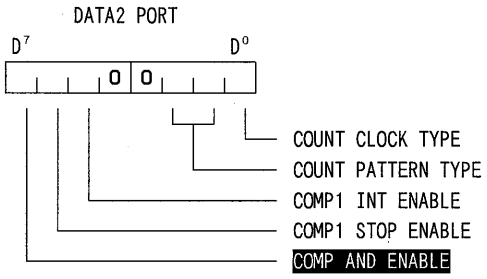
(5) DFL COMPARATOR1 TYPE (D^5,D^4),DFL COMPARATOR2 TYPE (D^7,D^6)

This bit is used for setting detecting conditions for the DIFFERENTIAL COUNTER comparator1 and 2.

D^5	D^4	Detecting condition
0	0	DIFFERENTIAL COUNTER≧DFL COMPARATOR1
0	1	DIFFERENTIAL COUNTER≦DFL COMPARATOR1
1	0	DIFFERENTIAL COUNTER=DFL COMPARATOR1
1	1	Setting is disabled.

D^7	D^6	Detecting condition
0	0	DIFFERENTIAL COUNTER≦DFL COMPARATOR2
0	1	DIFFERENTIAL COUNTER≧DFL COMPARATOR2
1	0	DIFFERENTIAL COUNTER=DFL COMPARATOR1
1	1	Setting is disabled.

Refer to the right for detail of the DRIVE DATA2 PORT.



Note: 2^3,2^4 bits must be set to 0.

The details of each bit of the DRIVE DATA2 PORT are as follows.
The bit is set to the underlined side at POWER ON/RESET.

(1) COUNT CLOCK TYPE (D^0)

This bit is used for selecting the operating clock for the DIFFERENTIAL COUNTER.

0: The DIFFERENTIAL COUNTER is operated by the deviation between the MCC05v2 output pulse ($\overline{CWP}$ and $\overline{CCWP}$) and the external clock from EA and EB input terminals.

1: The DIFFERENTIAL COUNTER is operated only by the external clock from the EA and EB input terminals.

Note: Depending on the product, EA and EB inputs may not be provided. Refer to each User's Manual.

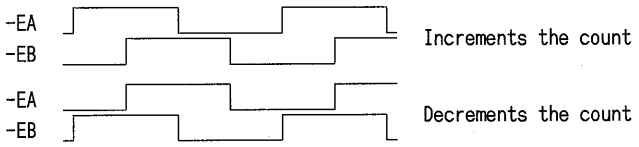
(2) COUNT PATTERN TYPE (D^1,D^2)

This bit is used for selecting an external input clock counting pattern on the DIFFERENTIAL COUNTER.

D^2	D^1	Count pattern	Input clock format
0	0	Counts the clock by multiplying the EA and EB input by 1.	90° phase differentiated clock
0	1	Counts the clock by multiplying the EA and EB input by 2.	
1	0	Counts the clock by multiplying the EA and EB input by 4.	
1	1	Incrementing with the EA and decrementing with the EB.	Direction-independent clock

Note: CW output pulse and CCW output pulse from the MCC05v2 starts incrementing and decrementing of the counter, respectively.

The following illustrates counting patterns introduced by 90° phase differentiated input.



(3) COMP1 INT ENABLE (D^5)

This bit is used for enabling or disabling output of DFLINT, the detection done by the DIFFERENTIAL COUNTER comparator1.

0: Disables the DFLINT output. 1: Enables the DFLINT output.

(4) COMP1 STOP ENABLE (D^6)

This bit is used for enabling or disabling the pulse output of the detection done by the DIFFERENTIAL COUNTER comparator1.

0: Does not stop the output. 1: Stops the output.

(5) COMP AND ENABLE (D^7)

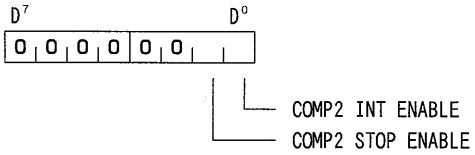
Detection done by COMPARATOR1 and 2 is normally ORed when output as DFLINT.
This bit is used for switching to it to ANDed output.

0: ORed output. 1: ANDed output.

When you selected ANDed output, both of he COMP1 and 2 INT ENABLE bits must be set to 1.
If either of them is set 0, DFLINT output is disabled.

Refer to the right for detail of the DRIVE DATA2 PORT.

DATA3 PORT



Note: 2^2 to 2^7 bits must be set to 0.

The details of each bit of the DRIVE DATA3 PORT are as follows.
The bit is set to the underlined side at POWER ON/RESET.

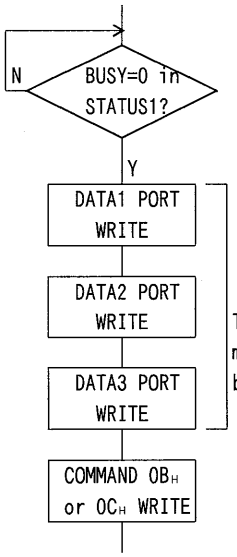
(1) COMP2 INT ENABLE (D^0)
This bit is used for enabling or disabling output of DFLINT, the detection done by the DIFFERENTIAL COUNTER comparator2.
0: Disables DFLINT output. 1: Enables DFLINT output.

(2) COMP2 STOP ENABLE (D^1)
This bit is used for enabling or disabling the pulse output of the detection done by the DIFFERENTIAL COUNTER comparator2.
0: Does not stop the output. 1: Stops the output.

19-4. CW, CCW SOFT LIMIT SET Command

COMMAND····· CW SOFT LIMIT [$0B_H$] CCW SOFT LIMIT [$0C_H$]

Execution sequence

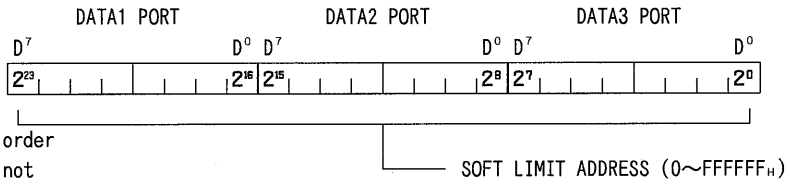


The order may not be observed.

Function : To set SOFT LIMIT address.

The soft limit address data is set in DRIVE DATA1, DRIVE DATA2 and DRIVE DATA3 PORT.

The contents of DRIVE DATA1 to DRIVE DATA3 are as follows.



When SOFT LIMIT ADDRESS is negative it is represented in 2's complement form.

· Setting example of SOFT LIMIT ADDRESS

ADDRESS(decimal)	DATA1 PORT	DATA2 PORT	DATA3 PORT
+8,388,607	$7F_H$	FF_H	FF_H
+10	00_H	00_H	$0A_H$
±0	00_H	00_H	00_H
-10	FF_H	FF_H	$F6_H$
-8,388,607	80_H	00_H	01_H

Note1: If you specify 800000_H for the address, it will be corrected as follows:
When CW SOFT LIMIT is selected ····· $7FFFFF_H$.
When CCW SOFT LIMIT is selected ···· 800001_H.
Note2: If you specify CW SOFT LIMIT≦CCW SOFT LIMIT, no operation other than the ORIGIN DRIVE will be available.
Note3: At POWER ON/RESET, both CW and CCW SOFT LIMIT are set to 0.
If you enable this setting, no operation other than the ORIGIN DRIVE will be available.

19-5.Setting is disabled Command ®2

COMMAND····· $0D_H$

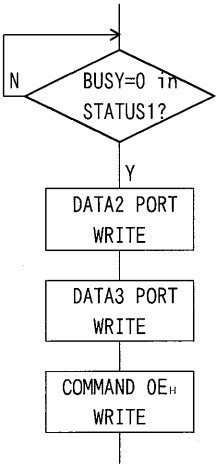
Function : Non-public functions are assigned.
Don't try to use it.

19-6.DFL DIVISION DATA SET Command

COMMAND····· $0E_H$

Function : Defines the division type for the clock entered to the DIFFERENTIAL COUNTER.

Execution sequence



Specify the division type on the DRIVE DATA2 PORT.
The contents of DRIVE DATA2 WRITE PORT are as follows.

DATA2 PORT

D^7						D^0
0	0	0	0	0	0	

DIVISION TYPE

Note: 2^2 to 2^7 bits must be set to 0.

Specifies the division data on the DRIVE DATA3 PORT (Note1).
The contents of DRIVE DATA3 WRITE PORT are as follows.

DATA3 PORT

D^7						D^0
2^7						2^0

Division data (0 to FF_H)
0 selects 256 division.

Note1: This setting is disabled if "No Division" is selected for the division type.
Note2: Executing this command clears the DIFFERENTIAL COUNTER to 0.
Note3: When you use this command together and you use PO function, please be sure to set up SPEC INITIALIZE3 COMMAND after exectuting this command.
When SPEC INITIALIZE3 COMMAND is performed after this command, ORG DETECTION by PO input cannot be performed normally.

Details of the bits of each division type are as follows.
The bit is set to the underlined side at POWER ON/RESET.

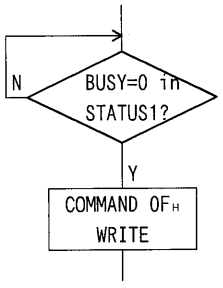
D^1	D^0	Division type for the input clock to the DIFFERENTIAL COUNTER.
0	0	No division
0	1	Divides output pulse from MCC05v2.
1	0	Divides input from EA and EB.
1	1	Setup prohibited(DIFFERENTIAL COUNTER will become inoperable).

19-7.SENSOR INDEX3 DATA SET Command

COMMAND····· $0F_H$

Function : Executes internal data processing for the SENSOR INDEX3 DRIVE.

Execution sequence



When the SENSOR INDEX3 DRIVE is selected, you need to process internal data beforehand using the operation parameters so that the drive is decelerated to the LSPD before it comes to stop. This processing is also required even when a specified pulse number is few.
This command is intended for this data processing.
The following operation parameters can affect the SENSOR INDEX3 DRIVE.
If any of them is modified, you must execute this command before proceeding to the SENSOR INDEX3 DRIVE. If not, an error will be indicated and, thus, the drive will be unavailable(except when HSPD is changed).

- DRIVE TYPE(SPEC INITIALIZE1)
- RATE (including the RESOLUTION in the Arithmetic Mode)
- LSPD

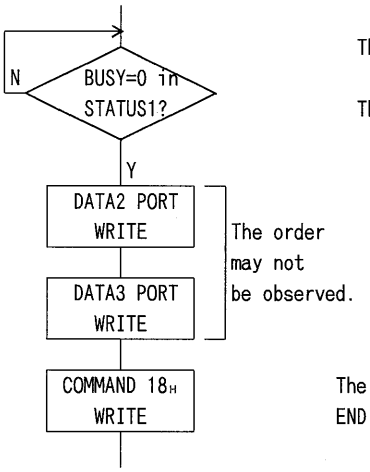
When none of them is touched and this command has been executed once, you need not execute this command again prior to the drive.

19-8. END PULSE SET Command

COMMAND····· 18H

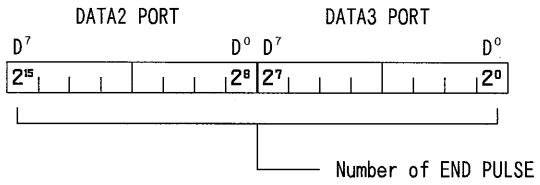
Function : To set pulse number for the END PULSE DRIVE after the end of INDEX DRIVE.

Execution sequence



The number of END PULES is specified in DRIVE DATA2 and DRIVE DATA3 PORT.

The contents of DRIVE DATA2 PORT and DRIVE DATA3 PORT are as follows.



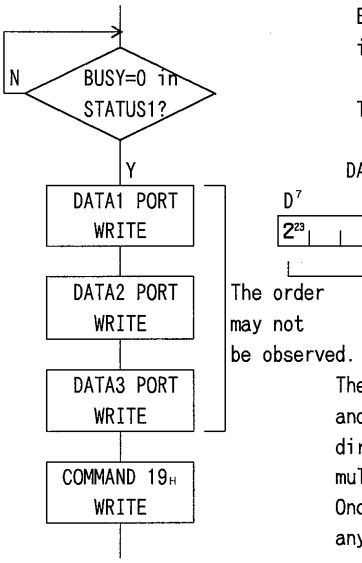
The END PULSE number setting range is from 0(0_H) to 65535($FFFF_H$)
END PULSE is 0 at POWER ON/RESET.

19-9. ESPD SET Command

COMMAND····· 19H

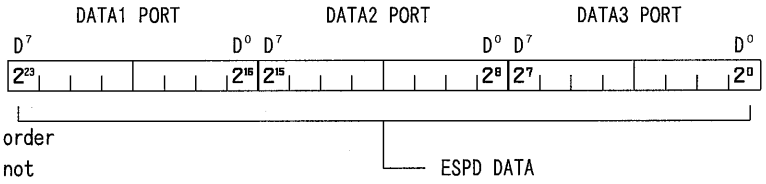
Function : To set speed (ESPD) of the END PULSE DRIVE after the end of the INDEX DRIVE.

Execution sequence



ESPD is set in DRIVE DATA1 PORT, DRIVE DATA2 PORT and DRIVE DATA3 PORT in 3-byte data in Hz.

The contents of DRIVE DATA1 PORT to DRIVE DATA3 PORT are as follows.



The detail of the ESPD DATA vary with the speed data setting mode, and the maximum setting ranges are from 1(1_H) to 3,333,333($32DCD5_H$) for Hz direct setting and from 48(30_H) to 16,777,215($FFFFFF_H$) for reference clock multiple setting.
Once the ESPD SET Command is executed, resetting is not required unless any change is necessary. ESPD is 300Hz at POWER ON/RESET.

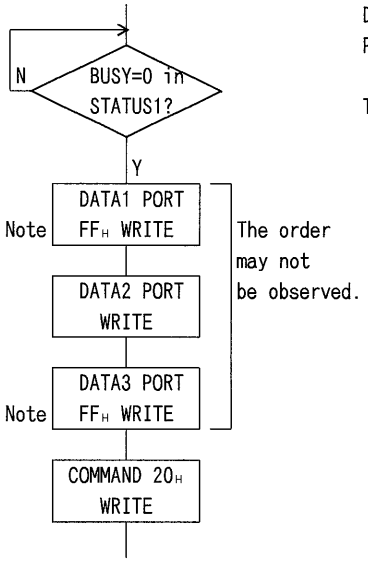
Note: The ESPD data setting range are 1Hz to LSPD.

19-10. SPEC INITIALIZE3 Command

COMMAND····· 20_H

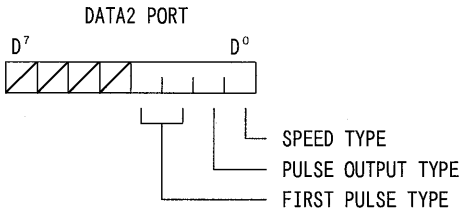
Function : To set specification for operation.

Execution sequence



Designate the performance specification of DRIVE PULSE to the DRIVE DATA2 PORT.

The contents of DRIVE DATA2 PORT is as follows.



The bit marked slash may be set to 0 or 1.

Note: DRIVE DATA1 and 3 PORT must to be set FF$_H$.

The details of bits of the DATA2 PORT are as follows. The bit is set to the underlined side at POWER ON/RESET.

(1) SPEED TYPE (D^0)

Specifies method of various speed data.

0 : Hz direct setting, 1 : Reference clock multiple setting

Note: Even if the data setting method is changed by this command after setting speed data, the speed data before execution of the command will be retained.

(2) PULSE OUTPUT TYPE (D^1)

Specifies output types of the pulse on pulse output terminal.

0 : +(CW) direction pulse is output from the $\overline{CWP}$ terminal and -(CCW) direction pulse is output from the $\overline{CCWP}$ terminal.

1 : Pulse is output from the $\overline{CWP}$ terminal and direction is output from the $\overline{CCWP}$ terminal.

Note: Direction outputs are LOW in the +(CW) direction and HIGH in the -(CCW) direction.

(3) FIRST PULSE TYPE (D^3, D^2)

Specifies the active width of the first drive pulse.

D^3	D^2	Active width
0	0	100μs
0	1	20μs
1	X	LSPD half period

19-11. Setting is disabled Command

COMMAND····· 21_H

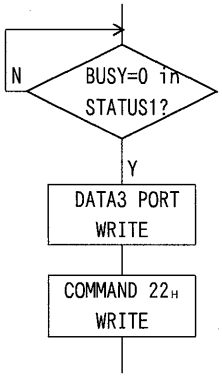
Function : Non-public functions are assigned.
Don't try to use it.

19-12. RESOLUTION SET Command

COMMAND····· 22_H

Function : To set the parameter, RESOLUTION DATA, which determines speed difference at the time of acceleration/deceleration drive.

Execution sequence



Set RESOLUTION DATA to the DRIVE DATA3 PORT.
The setting range is from $1(1_H)$ to $255(FF_H)$. At the time of POWER ON/RESET, 1 is set. The RESOLUTION SET Command is required only when the drive type is the Arithmetic Mode.
When the Fixed Mode is selected, an command error will occur and nothing will be executed.

Note: If the RESOLUTION DATA is re-written during S-RATE DRIVE, such parameters as SSRATE, SERATE, SCSPD1 and SCSPD2 will be reset to respective initial values. Be careful in the adjustment of parameters by the ADJUST Command.

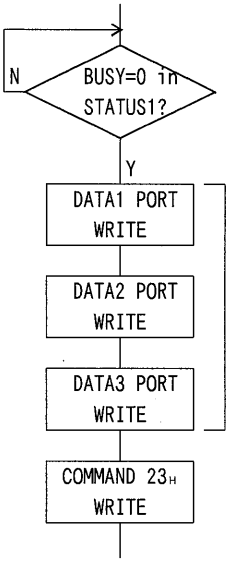
19-13. PART HSPD BUFFER SET Command

COMMAND····· 23H

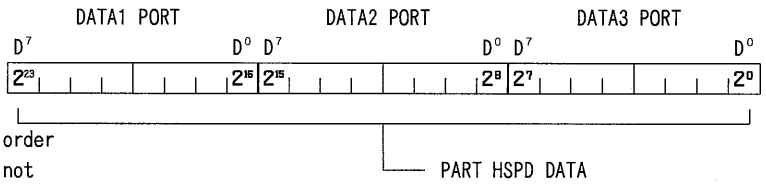
Function : To store HSPD1 to HSPD10 data in the buffer register temporarily as change target speed in the SPECIAL SCAN2 and SPECIAL INDEX 2 drives or as section speed in the SERIAL INDEX DRIVE.

PART HSPD is set in DRIVE DATA1 PORT, DRIVE DATA2 PORT and DRIVE DATA3 PORT in 3-byte data in Hz.

Execution sequence



The contents of DRIVE DATA1 PORT to DRIVE DATA3 PORT are as follows.



The details of PART HSPD DATA vary with data setting mode, and the maximum data setting ranges are from 1(1H) to 3,300,000(325AA0H) for Hz direct setting and from 48(30H) to 16,777,215(FFFFFFH) for reference clock multiple setting.
Once the PART HSPD SET Command is executed, resetting is not necessary unless any change is necessary.
At the time of POWER ON/RESET, HSPD1 to 10 are 3000Hz.

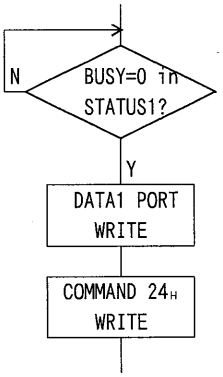
Note: The setting range of PART HSPD DATA varies with drive type, and the setting range is the same as HSPD of general drive. For the detail, refer to the User's Manual.

19-14. PART HSPD SET Command

COMMAND····· 24H

Function : To store buffer data set by the PART HSPD BUFFER SET Command to a designated PART HSPD No.

Execution sequence



Set PART HSPD NO. to the DRIVE DATA1 PORT in the range from 1 (1H) to 10(AH). If invalid data are written, nothing will be executed.

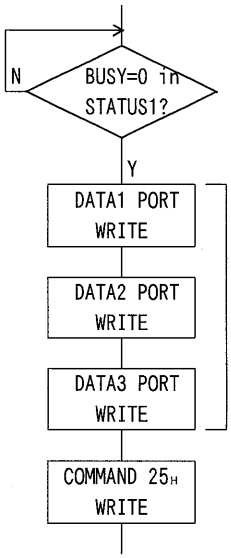
Note: **Be sure to execute this command right after execution of the PART HSPD BUFFER SET Command.**
If the drive type is changed by the SPEC INITIALIZE 1 Command or the RESOLUTION SET Command is executed after execution of the PART HSPD SET Command, the buffer register data will become invalid. And the execution of this command after that will result in malfunction. Take notice of this.

19-15. INCREMENTAL DATA SET Command

COMMAND····· 25H

Function : To set number of output pulses and direction at the time of SPECIAL INDEX1 and 2 drives of relative specified.

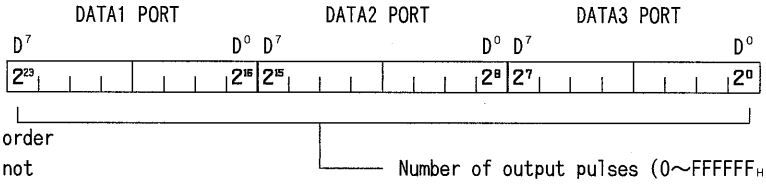
Execution sequence



The order may not be observed.

The number of output pulses and direction are specified in DRIVE DATA1 PORT, DRIVE DATA2 PORT and DRIVE DATA3 PORT.

The contents of DRIVE DATA1 to DRIVE DATA3 are as follows.



When set to -(CCW)direction, the number of output pulses is represented in 2's complement form.

· Setting example of the number of output pulses

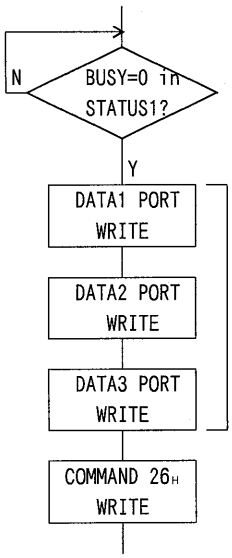
Output pulse (decimal)	DATA1 PORT	DATA2 PORT	DATA3 PORT
+8,388,607	7FH	FFH	FFH
+10	00H	00H	0AH
±0	00H	00H	00H
-10	FFH	FFH	F6H
-8,388,607	80H	00H	01H

19-16. ABSOLUTE DATA SET Command

COMMAND····· 26H

Function : To set destination absolute address in the SPECIAL INDEX1 and 2 drives of absolute specified.

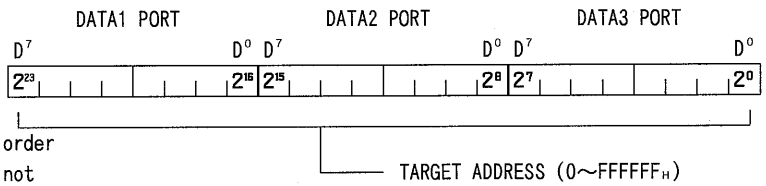
Execution sequence



The order may not be observed.

The absolute address of target location is specified in DRIVE DATA1 PORT, DRIVE DATA2 PORT and DRIVE DATA3 PORT.

The contents of DRIVE DATA1 PORT to DRIVE DATA3 PORT are as follows.



When TARGET ADDRESS is negative, it is represented in 2's complement form.

· Setting example of TARGET ADDRESS

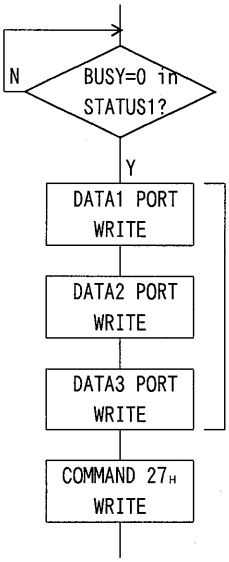
TARGET ADDRESS(decimal)	DATA1 PORT	DATA2 PORT	DATA3 PORT
+8,388,607	7FH	FFH	FFH
+10	00H	00H	0AH
±0	00H	00H	00H
-10	FFH	FFH	F6H
-8,388,607	80H	00H	01H

19-17. PART PULSE SET Command

COMMAND····· 27_H

Function : To set pulse number of each section in the SERIAL INDEX DRIVE.

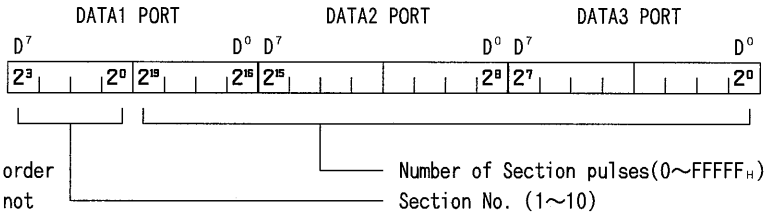
Execution sequence



The order may not be observed.

Section No. and number of Section pulses are set in DRIVE DATA1 PORT, DRIVE DATA2 PORT and DRIVE DATA3 PORT.

The contents of DRIVE DATA1 PORT to DRIVE DATA3 PORT are as follows.



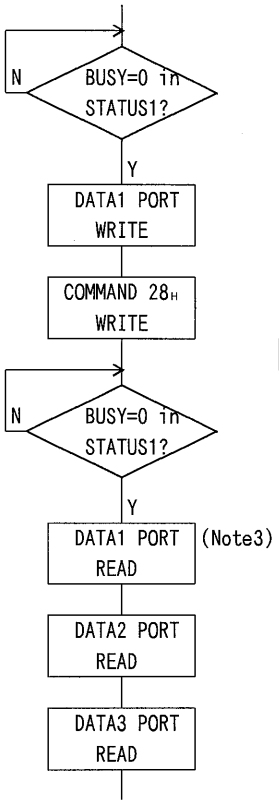
The setting range of Section No. is from 1 to 10.
The setting range of Number of Section Pulses is from 0 to 1,048,575($FFFFF_H$).
Make pulse numbers in unused sections 0. In this case the SERIAL INDEX DRIVE will end in the section just before where 0 is specified.

19-18. SERIAL INDEX CHECK Command

COMMAND····· 28_H

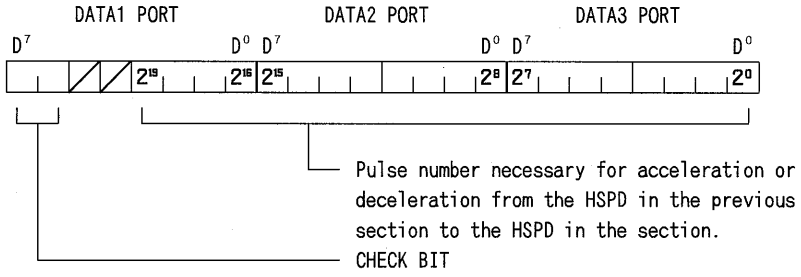
Function : To check number of pulses in each serial index section. For the check, the pulse number necessary for acceleration or deceleration from the HSPD in the section before the check to the HSPD in the section to be checked is simply calculated and is compared with section pulse number.

Execution sequence



Section No. is set in DRIVE DATA1 PORT (WRITE).
Read the check results and necessary pulse in each section from the DRIVE DATA1 PORT, DRIVE DATA2 PORT and DRIVE DATA3 PORT(READ).

The contents of DRIVE DATA1 PORT to DRIVE DATA3 PORT are as follows.



* Explanation of Check Bit (DATA1 PORT D^7, D^6)
The result of comparison of section pulse number with necessary pulse number is as follows:

D^7	D^6	Judgement Results
0	0	Acceleration or deceleration to the section HSPD is possible.
0	1	The section pulse number is smaller than the necessary pulse number.
1	0	The necessary pulse number is over 1,048,575. (Note 1)
1	1	The section pulse number is smaller than specified pulse number. (Note 2)

Note1: In this case, 0 is read as the pulse number.

Note2: When the check in Section 1 resulted in this judgement, starting a SERIAL INDEX DRIVE will result in a COMMAND ERROR and no drive will not be realized.
When this judgement result is obtained in Sections 2 to 9, these sections will be regarded as invalid ones, and the part pulses in these sections will be absorbed in the previous valid section.
For the detail of specified pulse number, see 3-5.

Note3: Be sure to read data in the order of DRIVE DATA1 to 3 PORT. DRIVE DATA1, 2 and 3 PORT are generally special ports to read values of the any counter or present speed data.
Functions of these ports are changed over by writing the SERIAL INDEX CHECK Command, and this port will become the one to read check data. The function as the check data reading port is canceled by reading the DRIVE DATA3 PORT and returns to the original port function.
So, be sure to read the DRIVE DATA3 PORT after having written the SERIAL INDEX CHECK Command.

Other Precautions:

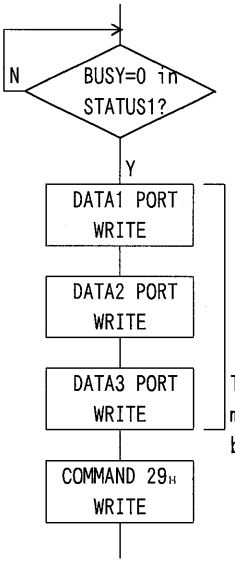
1. Writing invalid data in the DRIVE DATA1 PORT will result in a command error.
2. The pulse number obtained by this command is the one only in the speed adjusting range in each section. So, even if the same value as the pulse number to be obtained by this command is set as the PART PULSE, it will not reach the PART HSPD as a rule, and the speed adjustment will end with the speed one level slower than the PART HSPD. To let the speed after the speed adjustment reach the PART HSPD in an actual drive, the pulse number obtained by adding the specified pulse number to the one obtained by this command is necessary at least. (In the final section, however, the value obtained by adding 1 to the pulse number obtained by this command is the minimum one.)
   Please note that the judgments of check bits of this command are based on this principle.
3. The judgement results of the check bit of this command are guaranteed only when the judgement in the section before the check makes speed changes up to HSPDs in all sections possible.
   In other cases, actual drives may result in differently from the judgement results.
   Take notice of this.

19-19. PART RATE SET Command

COMMAND····· 29_H

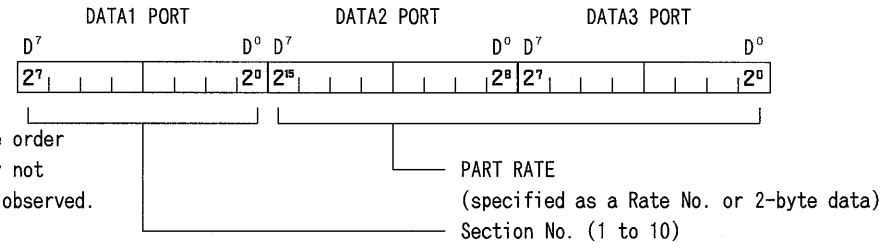
Function : Sets the rate in each section when the SPECIAL SERIAL INDEX DRIVE is selected.

Execution sequence



When the Fixed Mode is selected for the drive type, this command sets the part rate in the DRIVE DATA3 PORT as a number of the data table.
When the operation mode is selected, the part rate is set in the DRIVE DATA 2 and 3 PORTs as 2-byte data.
Specify a section number to the DRIVE DATA1 PORT.

The contents of DRIVE DATA1 to DRIVE DATA3 are as follows.



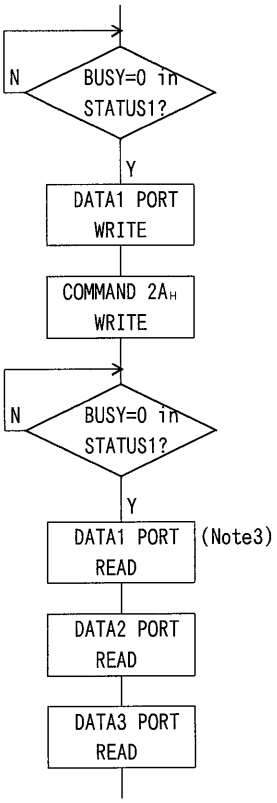
Section No. is 9 at POWER ON/RESET

19-20. SPECIAL SERIAL INDEX CHECK Command

COMMAND····· $2A_H$

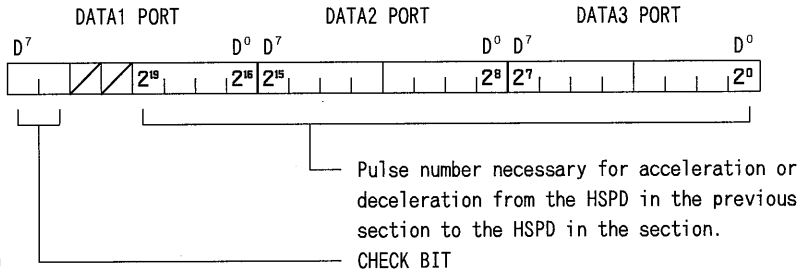
Function : Checks pulse number in each serial index drive section. For the check, the pulse number necessary for acceleration or deceleration from the HSPD in the section before the check to the HSPD in the section to be checked is simply calculated and is compared with section pulse number.

Execution sequence



Section No. is set in DRIVE DATA1 PORT (WRITE).
Read the check results and necessary pulse in each section from the DRIVE DATA1 PORT, DRIVE DATA2 PORT and DRIVE DATA3 PORT(READ).

The contents of DRIVE DATA1 to DRIVE DATA3 are as follows.



* Explanation of Check Bit (DATA1 PORT D^7, D^6)
The result of comparison of section pulse number with necessary pulse number is as follows:

D^7	D^6	Judgement Results
0	0	Acceleration or deceleration to the section HSPD is possible.
0	1	The section pulse number is smaller than the necessary pulse number.
1	0	The necessary pulse number is over 1,048,575. (Note 1)
1	1	The section pulse number is smaller than specified pulse number. (Note 2)

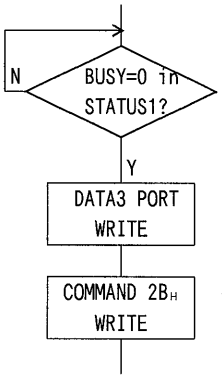
Notes 1, 2 and 3: The same comments as that for the SERIAL INDEX CHECK Command are applicable.
The same precautions as that for the SERIAL INDEX CHECK Command are applicable to this command, too.

19-21. MARGIN TIME SET Command

COMMAND····· $2B_H$

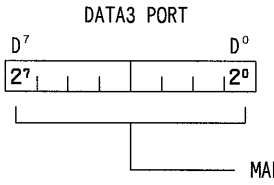
Function : To set MARGIN TIME in machine origin detecting drive

Execution sequence



MARGIN TIME is set in DRIVE DATA3 PORT.

The contents of DRIVE DATA3 WRITE PORT are as follows.



Data ranges from 00_H to FF_H and are set in units of 0.2ms.

Example :

00_H ····· No MARGIN TIME.

$0A_H$ ····· 2ms

FF_H ····· 51ms

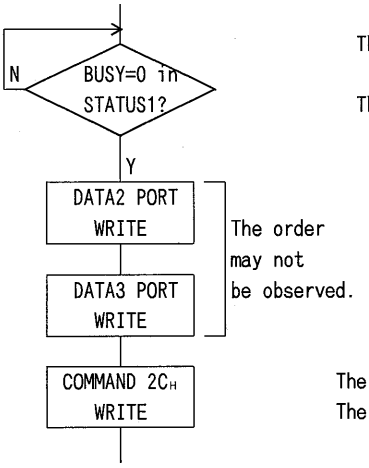
MARGIN TIME is set to 0 at POWER ON/RESET.

19-22. PEAK PULSE SET Command

COMMAND····· $2C_H$

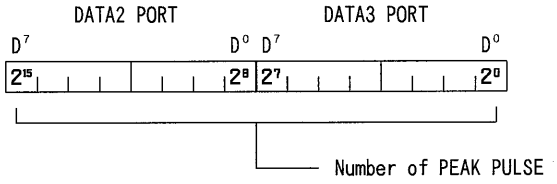
Function : To set pulse number in the peak constant speed running area in the S-RATE INDEX DRIVE.

Execution sequence



The peak pulse is set in DRIVE DATA2 PORT and DRIVE DATA3 PORT.

The contents of DRIVE DATA2 PORT and DRIVE DATA3 PORT are as follows.



The peak pulse number setting range is from $2(2_H)$ to 65535 ($FFFF_H$). (Note)

The peak pulse is set to 2 at POWER ON/RESET.

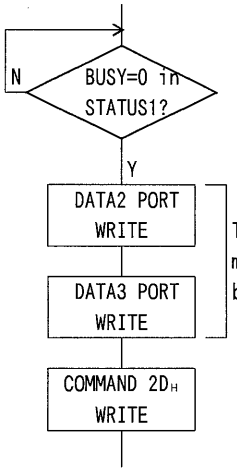
Note: The peak pulse is subject to the minimum value limit by setting SHSPD.
When the peak pulse is set below the minimum value, the minimum value is used as the peak pulse in actual drive.
For the detail of the minimum value, see 9-2.

19-23. SEND PULSE SET Command

COMMAND····· 2D$_H$

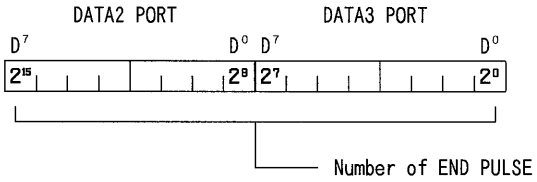
Function : To set pulse number for the END PULSE DRIVE after the end of the S-RATE INDEX DRIVE.

Execution sequence



SEND PULSE is set in DRIVE DATA2 PORT and DRIVE DATA3 PORT.

The contents of DRIVE DATA2 PORT and DRIVE DATA3 PORT are as follows.



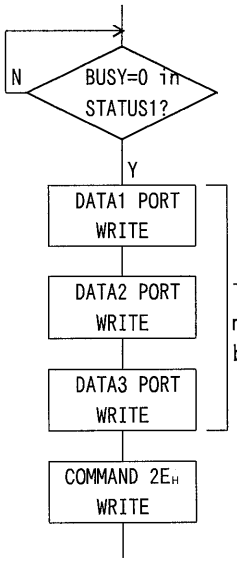
The END PULSE number setting range is from 0(0$_H$) to 65535(FFFF$_H$)
The END PULSE number is 0 at POWER ON/RESET.

19-24. SESPD SET Command

COMMAND····· 2E$_H$

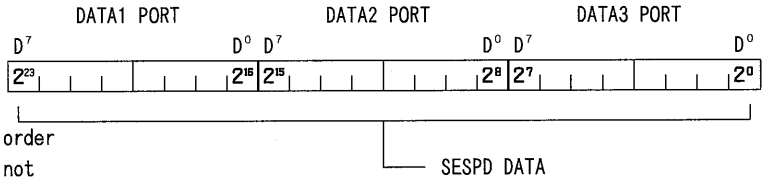
Function : To set speed (SESPD) of the END PULSE DRIVE after the end of the S-RATE INDEX DRIVE.

Execution sequence



SESPD is set in DRIVE DATA1 PORT, DRIVE DATA2 PORT and DRIVE DATA3 PORT in 3-byte data in Hz.

The contents of DRIVE DATA1 PORT to DRIVE DATA3 PORT are as follows.



The detail of the SESPD DATA vary with the speed data setting mode, and the maximum setting ranges are from 1(1$_H$) to 3,300,000(325AA0$_H$) for Hz direct setting and from 48(30$_H$) to 16,777,215-(FFFFFF$_H$) for reference clock multiple setting.
Once the SESPD SET Command is executed, resetting is not required unless any change is necessary. SESPD is 300Hz at POWER ON/RESET.

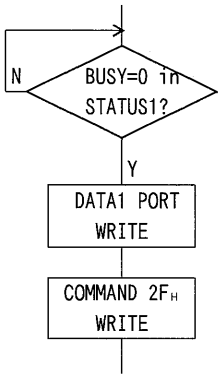
Note: However, The SESPD data setting range are 1Hz to LSPD.

19-25. SPEC INITIALIZE4 Command

COMMAND····· $2F_H$

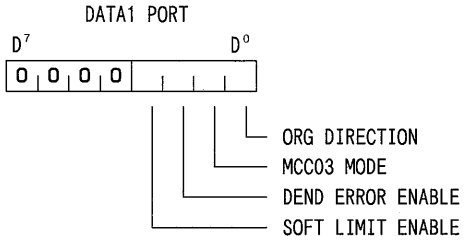
Function : Specifies ORIGIN DRIVE detection direction, MCC03 COMPATIBLE MODE, DEND ERROR and SOFT LIMIT.

Execution sequence



Specifications are defined in DRIVE DATA1 PORT.

The contents of DRIVE DATA1 PORT is as follows.



Note: 2^4 to 2^7 bits must be set to 0.

The detail of each bit is as follows: Settings at POWER ON/RESET are the underlined side.

(1) ORG DIRECTION (D^0)
This bit is for specified the ORIGIN DRIVE detecting direction.
0 : -(CCW) direction, 1 : +(CW) Direction

(2) MCC03 MODE (D^1)
This bit is used for selecting the mode which allows your MCC05v2 to operate in the MCC03 compatible mode.

0: Usual specification. 1: MCC03 compatible specification.
As for Board Controllers, **0 must be specified for this bit.**

(3) DEND ERROR ENABLE (D^2)
This bit is used for enabling or disabling the DEND ERROR detection function.
0: Disable. 1: Enable.
Whenever enabling this function, an error determination time must specified with the DEND TIME SET Command.

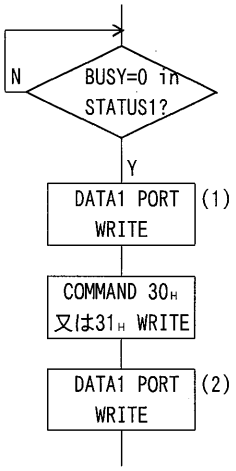
(4) SOFT LIMIT ENABLE (D^3)
This bit is used for enabling or disabling the SOFT LIMIT function.
0: Disable. 1: Enable.
Whenever enabling this function, the LIMIT address must also be set with the CW/CCW SOFT LIMIT Command.
With the initial data, the ORIGIN DRIVE alone is available.

Note: Executing this command resets the ORIGIN FLAG and, thus, SOFT LIMIT BIT on the STATUS5 PORT is cleared.

19-26. +/-SPECIAL SCAN1 Command

COMMAND····· Drive in +(CW)direction [30H] Drive in -(CCW)direction [31H]

Execution sequence



Function : Performs SPECIAL SCAN1 DRIVE.

Set any of the UP, DOWN and CONSTANT data to the DRIVE DATA1 PORT.

The data to be set at (1) determines the drive status after the start.
DOWN or CONSTANT ····· Constant speed drive of LSPD.
UP or invalid data ····· Acceleration drive of URATE.

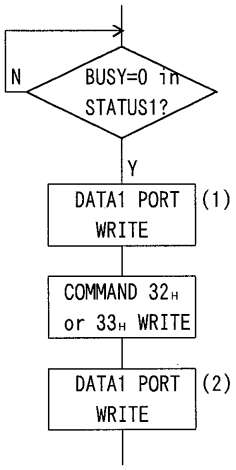
The data to be set at (2) are necessary when a drive status is change (a speed is changed).

UP DATA (Acceleration command) ····· 01H
DOWN DATA (Deceleration command) ····· 02H
CONSTANT DATA (Constant speed command) ····· 03H

19-27. +/-SPECIAL SCAN2 Command

COMMAND····· Drive in +(CW)direction [32H] Drive in -(CCW)direction [33H]

Execution sequence



Function : Performs SPECIAL SCAN2 DRIVE.

Designate the HSPD No. where the target speed to be change is stored to the DRIVE DATA1 PORT.

The data to be designated at (1) determines the output pulse speed after the start.
Target speed ≦ LSPD ··· Constant speed drive of LSPD
Target speed > LSPD ··· Acceleration drive up to the target speed of URATE.

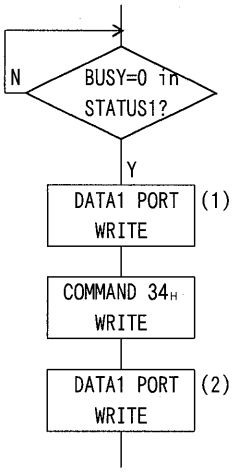
The data to be set at (2) are necessary when a drive status is changed (a speed is changed).
Target speed > Present speed ··· Acceleration drive up to the target speed of URATE.
Target speed = Present speed ··· Constant speed drive of present speed.
Target speed < Present speed ··· Deceleration drive up to the target speed of DRATE.

19-28. SPECIAL INCREMENTAL INDEX1 Command

COMMAND····· 34H

Function : Performs the SPECIAL INDEX1 DRIVE with relative specified.

Execution sequence



Set any of the UP, DOWN and CONSTANT data to the DRIVE DATA1 PORT.

The data to be set at (1) determines the drive status after the start.
DOWN or CONSTANT ····· Constant speed drive of LSPD.
UP or invalid data ····· Acceleration drive of URATE.

The data to be set at (2) are necessary when a drive status is change (a speed is changed).

UP DATA (Acceleration command) ····· 01H
DOWN DATA (Deceleration command) ····· 02H
CONSTANT DATA (Constant speed command) ····· 03H

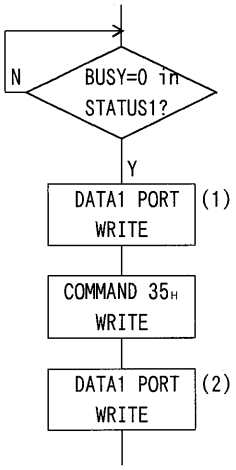
Note: Output pulse number and drive direction have to be set in advance by the INCREMENTAL DATA SET Command.

19-29. SPECIAL ABSOLUTE INDEX1 Command

COMMAND····· 35H

Function : Performs the SPECIAL INDEX1 DRIVE with absolute specified.

Execution sequence



Set any of the UP, DOWN and CONSTANT data to the DRIVE DATA1 PORT.

The data to be set at (1) determines the drive status after the start.
DOWN or CONSTANT ····· Constant speed drive of LSPD.
UP or invalid data ····· Acceleration drive of URATE.

The data to be set at (2) are necessary when a drive status is change (a speed is changed).

UP DATA (Acceleration command) ····· 01H
DOWN DATA (Deceleration command) ····· 02H
CONSTANT DATA (Constant speed command) ····· 03H

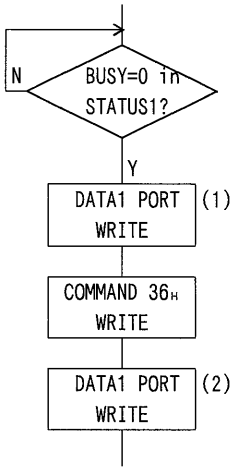
Target speed < Present speed ··· Deceleration drive up to the target speed of DRATE.

19-30. SPECIAL INCREMENTAL INDEX2 Command

COMMAND····· 36H

Function : Performs the SPECIAL INDEX2 DRIVE with relative specified.

Execution sequence



Designate the HSPD No. where the target speed to be change is stored to the DRIVE DATA1 PORT.

The data to be designated at (1) determines the output pulse speed after the start.
Target speed ≦ LSPD ··· Constant speed drive of LSPD
Target speed > LSPD ··· Acceleration drive up to the target speed of URATE.

The data to be set at (2) are necessary when a drive status is changed (a speed is changed).
Target speed > Present speed ··· Acceleration drive up to the target speed of URATE.
Target speed = Present speed ··· Constant speed drive of present speed.
Target speed < Present speed ··· Deceleration drive up to the target speed of DRATE.

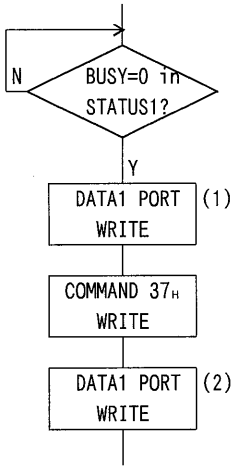
Note: Output pulse number and drive direction have to be set in advance by the INCREMENTAL DATA SET Command.

19-31. SPECIAL ABSOLUTE INDEX2 Command

COMMAND····· 37H

Function : Performs the SPECIAL INDEX2 DRIVE with absolute specified.

Execution sequence



Designate the HSPD No. where the target speed to be change is stored to the DRIVE DATA1 PORT.

The data to be designated at (1) determines the output pulse speed after the start.
Target speed ≦ LSPD ··· Constant speed drive of LSPD
Target speed > LSPD ··· Acceleration drive up to the target speed of URATE.

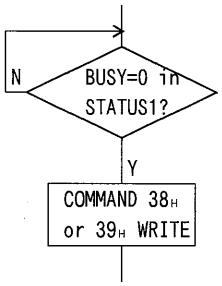
The data to be set at (2) are necessary when a drive status is changed (a speed is changed).
Target speed > Present speed ··· Acceleration drive up to the target speed of URATE.
Target speed = Present speed ··· Constant speed drive of present speed.
Target speed < Present speed ··· Deceleration drive up to the target speed of DRATE.

Note: Output pulse number and drive direction have to be set in advance by the ABSOLUTE DATA SET Command.

19-32. +/-SERIAL INDEX Command

COMMAND····· Drive in +(CW)direction [38H] Drive in -(CCW)direction [39H]

Execution sequence

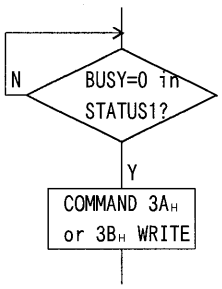


Function : Performs SERIAL INDEX DRIVE.

19-33. +/-SPECIAL SERIAL INDEX DRIVE Command

COMMAND····· Drive in +(CW)direction [3AH] Drive in -(CCW)direction [3BH]

Execution sequence



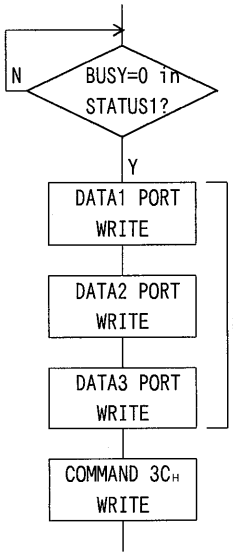
Function : Performs SPECIAL SERIAL INDEX DRIVE.

19-34. SENSOR INDEX1 Command

COMMAND····· [3CH]

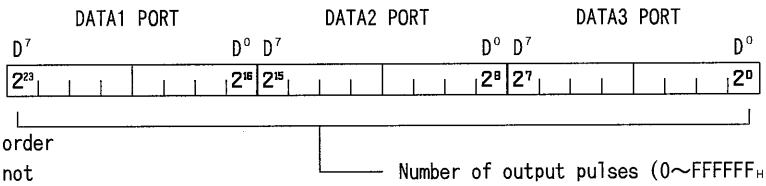
Function : Performs SENSOR INDEX1 DRIVE.

Execution sequence



The number of output pulses and the direction are specified in DRIVE DATA1 PORT, DRIVE DATA2 PORT and DRIVE DATA3 PORT.

The contents of DRIVE DATA1 PORT to DRIVE DATA3 PORT are as follows.



When set to -(CCW)direction, the number of output pulses is represented in 2's complement form.

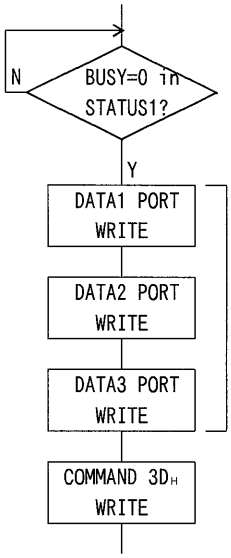
· Setting example of the number of output pulses

Output pulse (decimal)	DATA1 PORT	DATA2 PORT	DATA3 PORT
+8,388,607	7FH	FFH	FFH
+10	00H	00H	0AH
±0	00H	00H	00H
-10	FFH	FFH	F6H
-8,388,607	80H	00H	01H

19-35. SENSOR INDEX2 Command

COMMAND····· 3D$_H$ Function : Performs SENSOR INDEX2 DRIVE.

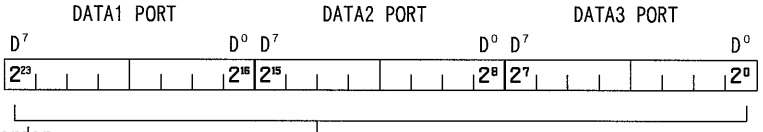
Execution sequence



The order may not be observed.

The number of output pulses and the direction are specified in DRIVE DATA1 PORT, DRIVE DATA2 PORT and DRIVE DATA3 PORT.

The contents of DRIVE DATA1 PORT to DRIVE DATA3 PORT are as follows.



When set to -(CCW)direction, the number of output pulses is represented in 2's complement form.

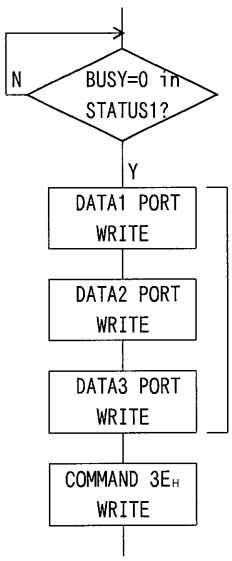
· Setting example of the number of output pulses

Output pulse (decimal)	DATA1 PORT	DATA2 PORT	DATA3 PORT
+8,388,607	7F$_H$	FF$_H$	FF$_H$
+10	00$_H$	00$_H$	0A$_H$
±0	00$_H$	00$_H$	00$_H$
-10	FF$_H$	FF$_H$	F6$_H$
-8,388,607	80$_H$	00$_H$	01$_H$

19-36. SENSOR INDEX3 Command

COMMAND····· 3E$_H$ Function : Performs SENSOR INDEX3 DRIVE.

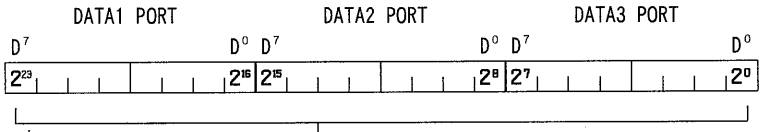
Execution sequence



The order may not be observed.

The number of output pulses and the direction are specified in DRIVE DATA1 PORT, DRIVE DATA2 PORT and DRIVE DATA3 PORT.

The contents of DRIVE DATA1 PORT to DRIVE DATA3 PORT are as follows.



When set to -(CCW)direction, the number of output pulses is represented in 2's complement form.

· Setting example of the number of output pulses

Output pulse (decimal)	DATA1 PORT	DATA2 PORT	DATA3 PORT
+8,388,607	7F$_H$	FF$_H$	FF$_H$
+10	00$_H$	00$_H$	0A$_H$
±0	00$_H$	00$_H$	00$_H$
-10	FF$_H$	FF$_H$	F6$_H$
-8,388,607	80$_H$	00$_H$	01$_H$

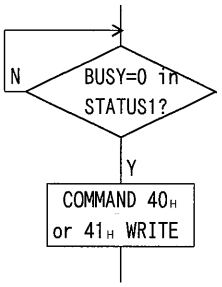
Note1: 0 being set for the output pulse number is processed as 1.

Note2: If the SENSOR INDEX3 DATA SET is not done beforehand, this drive is disabled as an error.

19-37. SENSOR SCAN1 COMMAND

COMMAND····· Drive in +(CW)direction [40_H] Drive in -(CCW)direction [41_H]

Execution sequence

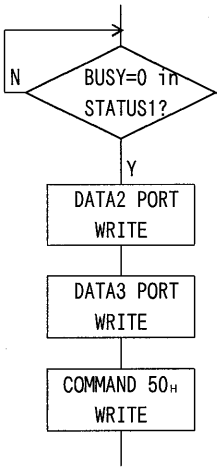


Function : Performs SENSOR SCAN1 DRIVE.

19-37. DEND TIME SET Command

COMMAND····· [50_H]

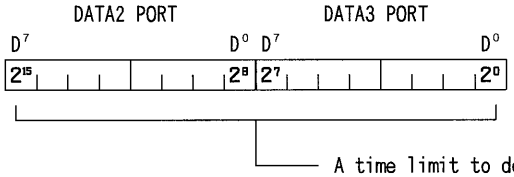
Execution sequence



Function : When the DEND ERROR DETECTION function is selected, this command specifies an allowable waiting time limit for the $\overline{DEND}$ signal to return.

Set an allowable time limit (a time limit to determining an error) to the DRIVE DATA1, 2 and 3 PORT in multiple of 5 ms.

The contents of DRIVE DATA2 PORT and DRIVE DATA3 PORT are as follows.



The DEND DATA setting range is from 1 (1_H) to 65535 ($FFFF_H$). At POWER ON/RESET, it is reset to $FFFF_H$.

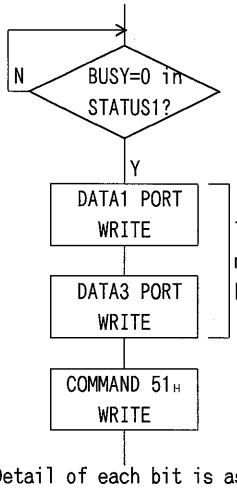
Setting example) 0001_H ····· 5ms
$000A_H$ ····· 50ms
$00FF_H$ ····· 1.275s
$FFFF_H$ ····· 327.675s

19-38. EXTEND ORIGIN SPEC SET Command

COMMAND····· 51H

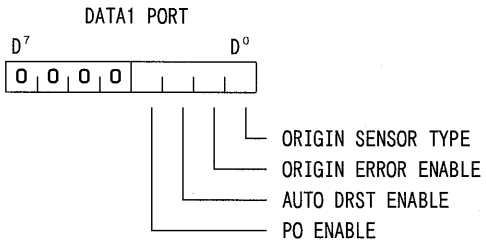
Function : Set up specifications for the EXPAND ORIGIN function.

Execution sequence



Set a specification for the EXPAND ORIGIN function to the DRIVE DATA1 PORT.

The contents of DRIVE DATA1 WRITE PORT are as follows.



Note: 2^4 to 2^7 bits must be set to 0.

Detail of each bit is as follows. At POWER ON/RESET, the underlined side is selected.

(1) ORIGIN SENSOR TYPE (D^0)

In the JOG DRIVE mode, this bit is used for specifying which of the signal edge or level is to be enabled for the sensor detection.

0: Edge. 1: Level.

(2) ORIGIN ERROR ENABLE (D^1)

This bit is used for enabling or disabling the origin sensor detection function.

0: Disable. 1: Enable.

(3) AUTO DRST ENABLE (D^2)

When the AUTO TYPE is selected for the motor type, this bit is used for enabling or disabling output of the $\overline{DRST}$ signal as the origin detection is completed.

0: Disables the $\overline{DRST}$ signal output.

1: Enables the $\overline{DRST}$ signal output.

(4) PO ENABLE (D^3)

This bit is used for enabling or disabling the PO input.

0: Disables $\overline{PO}$ input. 1: Enables $\overline{PO}$ input.

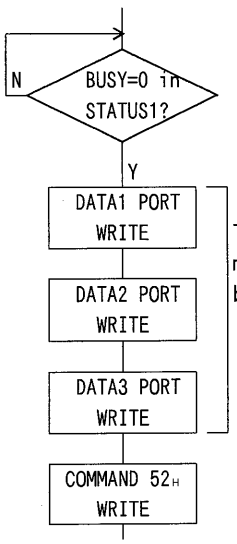
Set the maximum pulse number used in the JOG DRIVE process for the ORIGIN ERROR detection function to the DRIVE DATA3 PORT. The data is set in multiple of 1 pulse in the range from 00H to FFH. At POWER ON/RESET, 00H is selected. Specifying 00H, however, automatically sets 256 pulses.

19-39. CONSTANT SCAN MAX PULSE SET Command

COMMAND····· 52H

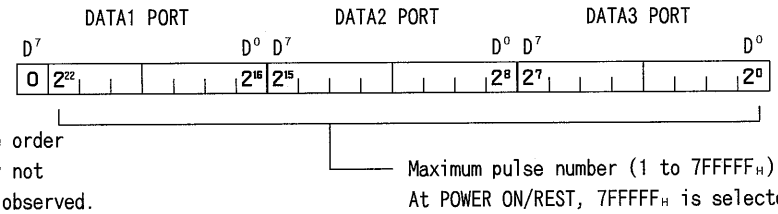
Function : Sets the maximum pulse number used in the CONSTANT SCAN DRIVE for the ORIGIN ERROR DETECTION function.

Execution sequence



Specify the maximum pulse number to the DRIVE DATA1, 2 and 3 PORT.

The contents of DRIVE DATA1 to DRIVE DATA3 are as follows.



· Setting example of maximum pulse number

Output pulse (decimal)	DATA1 PORT	DATA2 PORT	DATA3 PORT
+8,388,607	7FH	FFH	FFH
+10	00H	00H	0AH
0	00H	00H	00H

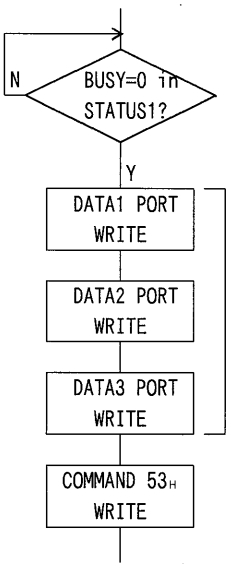
Note: 0 being set for the maximum pulse number is processed as 1.
Any number greater than 7FFFFH is processed as 7FFFFFH.

19-41. CHANGE POINT SET COMMAND

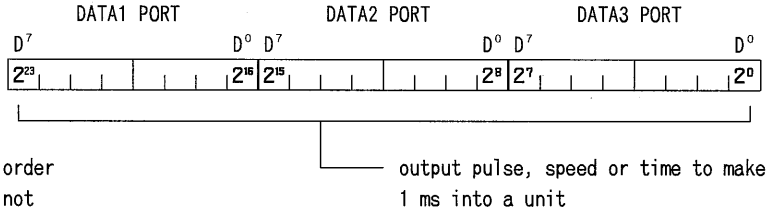
COMMAND····· 53H

Function : Set the change point data used in the AUTO CHANGE function.
The change point data are available in three types; for output pulse, speed and time. The type of data is determined by the AUTO CHANGE SET command. Therefore, AUTO CHANGE SET command must be written after execution of the command.

Execution sequence



Specify the change point data to the DRIVE DATA1, 2 and 3 PORT.
The contents of DRIVE DATA1 to DRIVE DATA3 are as follows.



In the case of output pulse, the maximum value is 8,388,607(7FFFFFH).
In the case of speed, the maximum value is 3,333,333607(32DCD5H).

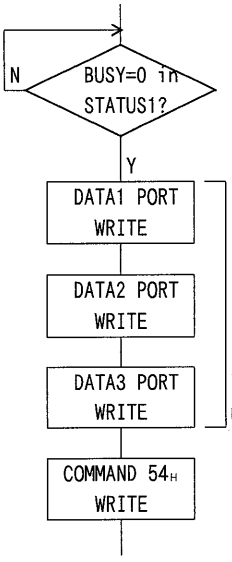
Note: The DATA set by this command can be read out by the SET DATA READ command.
Unlike other commands, the following DATA change values are output by specifying the AUTO CHANGE SET command:
When set as pulse ..... value corrected by MAX(7FFFFFH)
When set as a SPEED in increments of Hz ... INT(160,000,000÷(set DATA))
When set as a SPEED in increments of the number of clocks ..... Set DATA unchanged
When set as time in increments of 1 ms ..... INT(set DATA x 256)/262) + 1
* INT() denotes the integer part with all digits to the right of decimal point discarded.

19-42. CHANGE DATA SET COMMAND

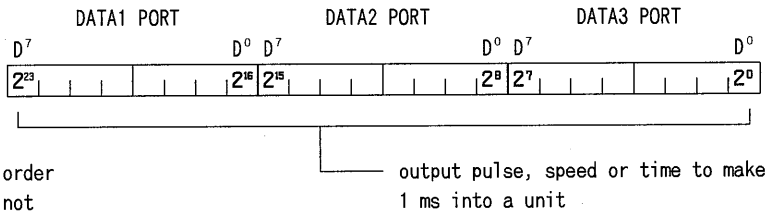
COMMAND····· 54H

Function : Sets the change (target) DATA used in the AUTO CHANGE function.
The change (target) DATA are available in two types; for SPEED and RATE. The type of data is determined by the AUTO CHANGE SET command. Therefore, AUTO CHANGE SET command must be written after execution of the command.

Execution sequence



Specify the SPEED or RATE to the DRIVE DATA1, 2 and 3 PORT.
The contents of DRIVE DATA1 to DRIVE DATA3 are as follows.



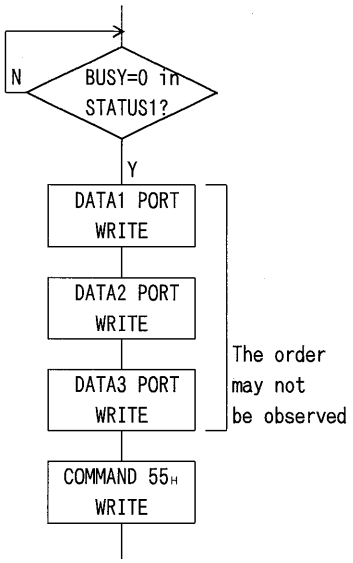
For RATE DATA, only the DATA3 PORT is enabled in the fixed mode, and only the DATA2 PORT and DATA3 PORT are enabled in the arithmetic mode.

19-43. AUTO CHANGE SET COMMAND

COMMAND····· 55_H

Function : Specifies the DATA and operation of AUTO CHANGE function. CHANGE POINT SET and CHANGE DATA SET command must have been executed immediately before execution of this command.(Note 1)

Execution sequence



Specifies the change point number (0 to 31) to the DATA1 PORT.
DATA ERROR will off if an other number is set.

Specifies at the DATA2 PORT whether the change point DATA (DATA set by CHANGE POINT SET) is the number of pulses, speed or time.
For SPEED DATA, also specifies whether changed at the time of acceleration or deceleration.

- 00_H ..... NOP(No Operation). Subsequent numbers are disabled.
- 01_H ..... As the number of pulses.
- 02_H ..... As time in unit of 1ms.
- 80_H ..... As an effective speed at the time of acceleration.
- 81_H ..... As an effective speed at the time of deceleration.

Specifies at the DATA3 PORT whether the change DATA (DATA set by CHANGE DATA SET) is SPEED or RATE. Stop command can also be specified.

- 00_H ..... As SPEED
- 01_H ..... As RATE
- 02_H ..... Performs slow stop from the change point, of the change DATA. (Note 2)
- 03_H ..... Performs immediate stop from the change point, independently of the change DATA.

Note 1: Three types of commands, CHANGE POINT SET, CHANGE DATA SET and AUTO CHANGE SET, must be used consecutively. If other DATA SET command and DRIVE command are executed between these commands, correct data cannot be set.

Note 2: When set as slow stop in the SENSOR SCAN1 DRIVE mode, the DRIVE does not stop but continues at the LSPD after deceleration. To stop the DRIVE in this case, use the $\overline{\text{SENSOR}}$ signal or FSSTOP.

Note 3: The CHANGE operation is performed in the order of change points. So even if the condition for a greater change point number is met first, this CHANGE operation is reserved. It is executed consecutively after the CHANGE operation of the previous number has been executed.

Example: Even if the condition of No.4 has been met earlier than that of No.3, priority is assigned to the condition of No.3. The system waits until the condition of No.3 is met. After the condition of No.3 is met, CHANGE processing of No.3 is executed consecutively. Then CHANGE processing of No.4 is executed. As a result, operation is performed such that CHANGE operations of Nos. 3 and 4 appear to be simultaneously executed at the change point of No.3. Therefore, if the CHANGE DATA of Nos. 3 and 4 are of the same type (SPEED or RATE), operation is performed such that No.3 will be ignored.

Supplement: The following shows the example to performed the DRIVE of the following specifications:

- Change point No.0: If the SPEED is exceeded 100 KHz after the DRIVE starts when the HSPD is set at 300 KHz, the RATE is changed to 8.
- Change point No.1: If the number of output PULSES has exceeded 200,000, the SPEED is changed to 150KHz.

(Sets change point No.0)

* 1. Sets 100,000 to DATA1 PORT to DATA 3 PORT, and executes the CHANGE POINT SET command.
2. Sets 8 to DATA3 PORT, and executes the CHANGE DATA SET command.
3. Sets 0 to DATA1, 80H to DATA2 and 01H to DATA3, and executes AUTO CHANGE SET command.

(Sets change point No.1)

* 4. Sets 200,000 to DATA1 PORT to DATA3 PORT and executes CHANGE POINT SET command.
5. Sets 150,000 to DATA1 PORT to DATA3 PORT and executes CHANGE DATA SET command.
6. Sets 2 to DATA1, 01H to DATA2 and 00H to DATA3, and executes AUTO CHANGE SET command.

(Sets change point No.2)

* 7. Sets 2 to DATA1, 00H to DATA2 and 00H to DATA3, and executes AUTO CHANGE SET command. (This is necessary in order to disable change point NO.1 and thereafter).

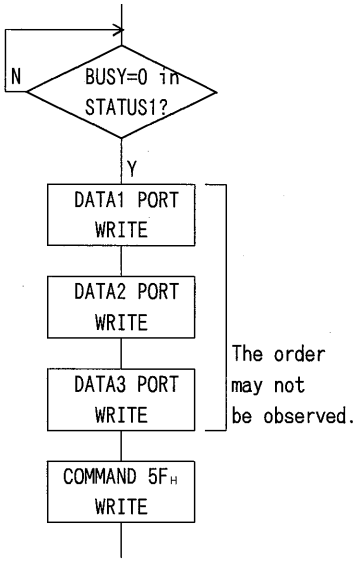
* Be sure to execute commands consecutively.

19-44. SPEC INITIALIZE5 COMMAND

COMMAND····· $5F_H$

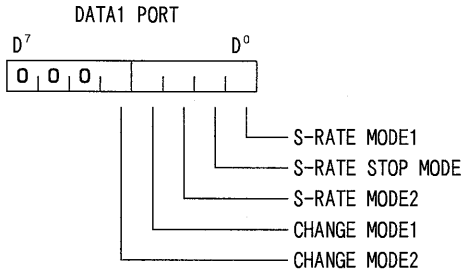
Function : Sets whether extended specifications are used or not.

Execution sequence



Defines the specifications to the DRIVE DATA1 PORT.

The following shows the contents of the DRIVE DATA1 PORT:



Note: Bits D^7, D^6, D^5 bits, DATA2 PORT and DATA3 PORT must be set to 0 for future expansion.

The following shows the details of bits DRIVE DATA1 PORT.
The underlined side will be selected when the setting is reset.

(1) S-RATE MODE1(D^0)
Selects whether the triangular drive workaround function is used or not.
0: Not used 1: Used

(2) S-RATE STOP MODE (D^1)
This bit is significant when the triangular drive workaround function is used.
It selects the slow stop type.
0: Not taken 1: taken

(3) S-RATE MODE2 (D^2)
This bit is used to select whether asymmetric S-RATE DRIVE is performed or not.
0: Not performed 1: Performed

If "Performed" is selected, the triangular drive workaround function will be disabled.

(4) CHANGE MODE1 (D^3)
Selects whether the CHANGE operation in the SCAN DRIVE mode is processed in real time or not.
0: Not processed 1: Processed

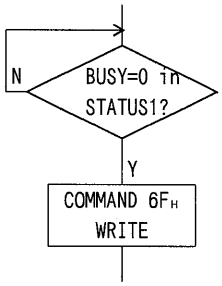
(5) CHANGE MODE2 (D^4)
This bit selects whether AUTO CHANGE function is used or not.
0: Not Used 1: used

19-45. SRATE DOWN POINT SET COMMAND

COMMAND ····· $6F_H$

Function : Processes calculation of deceleration points in the asymmetric S-RATE DRIVE mode.

Execution sequence



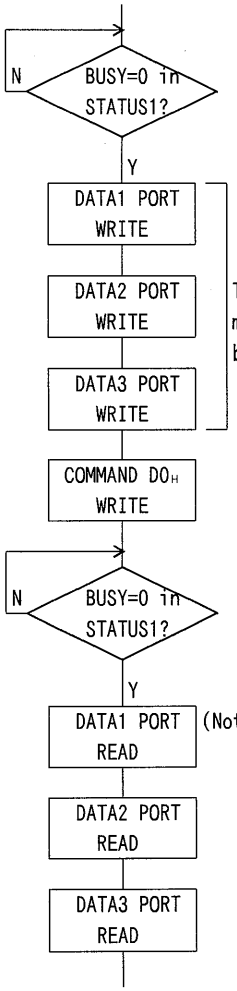
When the asymmetric S-RATE DRIVE is enabled, the SRATE DOWN POINT SET command must be executed once if the parameter (Refer to Chapter 14) of the S-RATE DRIVE is changed. If the S-RATE INDEX DRIVE is started without executing the command, a COMMAND ERROR (CODE = $0C_H$) will occur.
So long as the S-RATE DRIVE parameter is not changed, this command need not be executed again.

19-46. DRIVE CALCULATE COMMAND

COMMAND ····· $D0_H$

Function : Calculates DRIVE acceleration PULSE at the normal RATE by the currently set DRIVE parameter (RATE, LSPD, HSPD, etc.), and outputs the results.

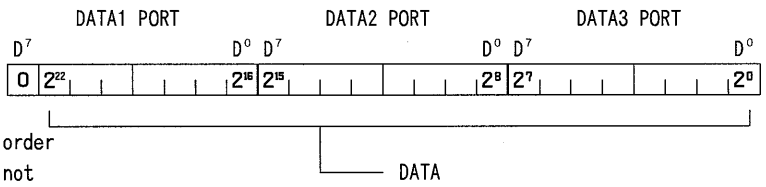
Execution sequence



The order may not be observed

Specifies DATA to DRIVE DATA 1, 2 and 3 WRITE PORT.

The following shows the contents of DRIVE DATA1, 2 and 3 WRITE PORT

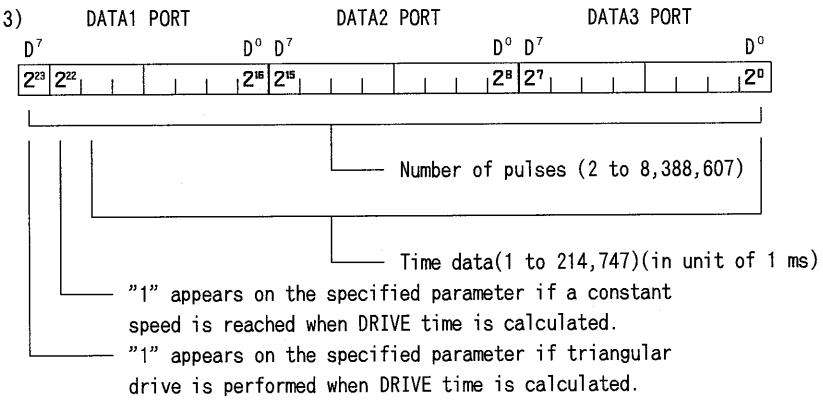


DATA
- 0 ..... Calculates the number of pulses until HSPD is reached from LSPD.
- 1 ..... Calculates the time until HSPD is reached from LSPD.
- 2 to 8,388,607 ... Calculates the DRIVE time when the set data is defined as the number of output pulses.

Reads out the result of calculation from the DRIVE DATA 1, 2 and 3 READ PORT.

The following shows the contents of the DRIVE DATA 1, 2 and 3 READ PORT.

(Note 3)



"1" appears on the specified parameter if a constant speed is reached when DRIVE time is calculated.
"1" appears on the specified parameter if triangular drive is performed when DRIVE time is calculated.

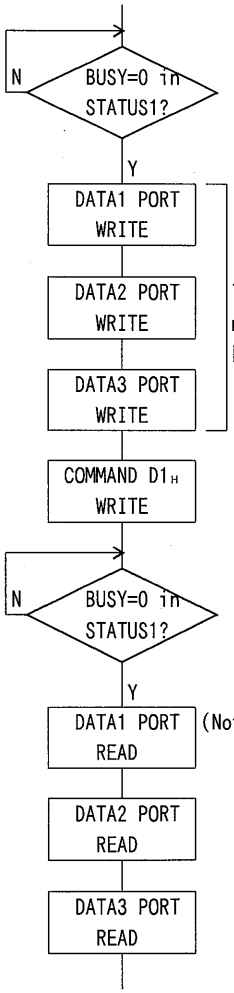
Note 1: When the number of pulses exceeds 8,388,607 as a result of calculation and time exceeds 214,747ms, overflow occurs and "0" is output.
Note 2: For the accuracy of calculation result, refer to the description of 17-3.
Note 3: DATA must be read in the order of DRIVE DATA1 PORT, DRIVE DATA2 PORT and DRIVE DATA3 PORT.

19-47. SRATE DRIVE CALCULATE COMMAND

COMMAND····· $D1_H$

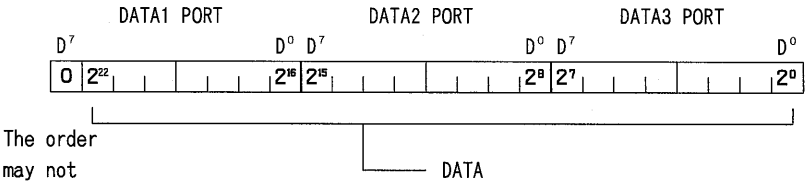
Function : Calculate the acceleration PULSE at the S-RATE by the currently set DRIVE parameter (SRATE, SLSPD, SHSPD, etc.), and outputs the results.

Execution sequence



Specifies DATA to DRIVE DATA 1, 2 and 3 WRITE PORT.

The following shows the contents of DRIVE DATA 1, 2 and 3 WRITE PORT:

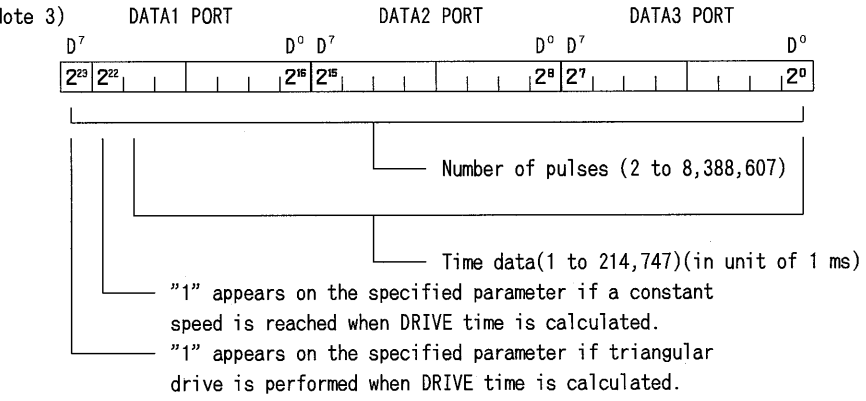


The order may not be observed

0 ..... Calculates the number of pulses until SHSPD is reached from SLSPD
1 ..... Calculates the time until SHSPD is reached from SLSPD.
2 to 8,388,607 ... Calculates the DRIVE time when the set data is defined as the number of output pulses.

Reads out the result of calculation from the DRIVE DATA 1, 2 and 3 READ PORT.

The following shows the contents of the DRIVE DATA 1, 2 and 3 READ PORT.



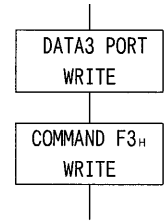
Note 1: When the number of pulses exceeds 8,388,607 as a result of calculation and time exceeds 214,747ms, overflow occurs and "0" is output.
Note 2: For the accuracy of calculation result, refer to the description of 17-3.
Note 3: DATA must be read in the order of DRIVE DATA1 PORT, DRIVE DATA2 PORT and DRIVE DATA3 PORT.

19-40. SIGNAL OUT Command

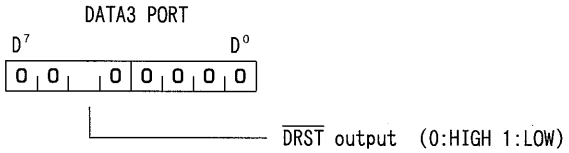
COMMAND····· $F3_H$

Function : Turns on or off the $\overline{DRST}$ as a general output.

Execution sequence



Specify an output level to the DRIVE DATA3 PORT.
The contents of DRIVE DATA3 WRITE PORT are as follows.



Note1: 0 must be set to all bits other than bit 2^5.
Note2: You need not to confirm BUSY=0 needs. However, you may not use this command to rewrite data on the DRIVE DATA3 PORT when writing is taking place with another command.

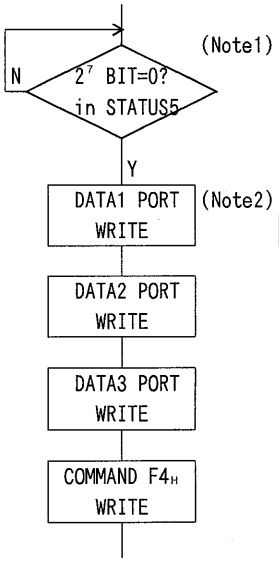
You can check current $\overline{DRST}$ output level from the STATUS4 PORT.

19-41. INDEX CHANGE command

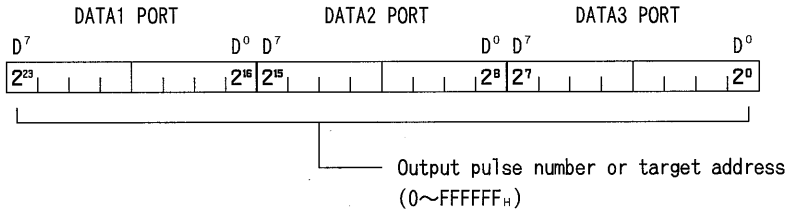
COMMAND····· $F4_H$

Function : In the INDEX or S-RATE INDEX DRIVE of the relative or absolute designation, this command use for modifying an output pulse number or target address.

Execution sequence



Specify an output pulse number or target address and direction to the DRIVE DATA1, 2 and 3 PORTs.
The contents of DRIVE DATA1 to DRIVE DATA3 are as follows.



The output pulse number or target address setting procedure is the same as that for the INCREMENTAL/ABSOLUTE INDEX Command.

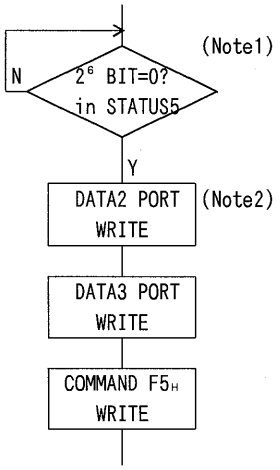
Note1: Before writing this command, make sure that 0 is set to INDEX CHANGE BUSY bit on the STATUS5 PORT.
Note2: Writing of the INDEX DATA must take place in the order of DATA1, 2 and 3 PORT. **If this order is changed, this data cannot be written.** (During write to the DATA3 PORT, 3-byte data is acquired.)
Note3: This command is valid for the INDEX and S-RATE INDEX DRIVE alone.

19-42. RATE CHANGE Command

COMMAND····· F5H

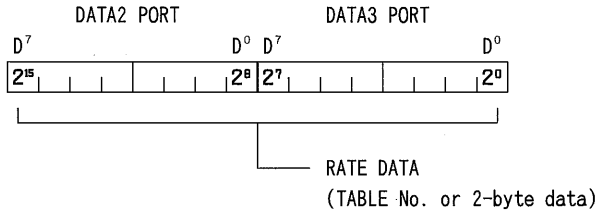
Function : Modifies the RATE during the SCAN DRIVE.

Execution sequence



When the Fixed Mode is selected for the DRIVE TYPE, set a DATA TABLE NO. to the DRIVE DATA3 PORT. When the Arithmetic Mode is selected, set a RATE to the DRIVE DATA2 and 3 PORTs as 2-byte data.

The contents of DRIVE DATA2 PORT and DRIVE DATA3 PORT are as follows.



Note1: Before writing this command, make sure that 0 is set to STATE CHANGE BUSY bit on the STATUS5 PORT.
Note2: Writing of the Arithmetic Mode must take place in the order of DATA2 and 3 PORT. **If this order is changed, this data cannot be written.** (During write to the DATA3 PORT, 3-byte data is acquired.)
Note3: This command is valid for the SCAN DRIVE alone.

19-43. DRST OUT Command

COMMAND····· F6H

Function : Outputs the $\overline{\text{DRST}}$ signal in multiple of 10 ms interval.

Although no specific execution sequence is required, re-trigger format of the command increases the output time when consecutively executed.

20. EXECUTION TIMES OF COMMANDS FOR SETTING DATA

20-1. Precautions

Execution times of these command contained in 16-2 greatly vary with drive type and the URATE≠DRATE conditions.

Select proper conditions so that command execution times do not cause any problem to the specifications.

20-2. List of Execution Times of Commands for Setting Data

(1) When URATE=DRATE.

COMMAND NAME	Execution time						
	Fixed Mode			Arithmetic Mode			
	L-TYPE	M-TYPE	H-TYPE	RESO=255	RESO=100	RESO=10	RESO=1
SPEC INITIALIZE1	MAX 1.2ms						
RATE SET	MAX 60μs						
LSPD SET	MAX 95μs						
SENSOR INDEX3 DATA SET	MAX 100ms	MAX 35ms	MAX 15ms	MAX 15ms	MAX 20ms	MAX 130ms	MAX 1.1s
RESOLUTION SET	---	---	---	MAX 590μs			
SERIAL INDEX CHECK	MAX 70ms	MAX 25ms	MAX 10ms	MAX 10ms	MAX 15ms	MAX 100ms	MAX 400ms
SPECIAL SERIAL INDEX CHECK	MAX 70ms	MAX 25ms	MAX 10ms	MAX 10ms	MAX 15ms	MAX 100ms	MAX 400ms

*Where, RESO is RESOLUTION value.

(2) When URATE≠DRATE.

COMMAND NAME	Execution time						
	Fixed Mode			Arithmetic Mode			
	L-TYPE	M-TYPE	H-TYPE	RESO=255	RESO=100	RESO=10	RESO=1
SPEC INITIALIZE1	MAX 100ms	MAX 35ms	MAX 15ms	MAX 15ms	MAX 22ms	MAX 130ms	MAX 1.1s
RATE SET	MAX 100ms	MAX 35ms	MAX 15ms	MAX 15ms	MAX 22ms	MAX 130ms	MAX 1.1s
LSPD SET	MAX 100ms	MAX 35ms	MAX 15ms	MAX 15ms	MAX 22ms	MAX 130ms	MAX 1.1s
SENSOR INDEX3 DATA SET	MAX 100ms	MAX 35ms	MAX 15ms	MAX 15ms	MAX 22ms	MAX 130ms	MAX 1.1s
RESOLUTION SET	---	---	---	MAX 15ms	MAX 22ms	MAX 130ms	MAX 1.1s
SERIAL INDEX CHECK	MAX 70ms	MAX 25ms	MAX 10ms	MAX 10ms	MAX 15ms	MAX 100ms	MAX 400ms
SPECIAL SERIAL INDEX CHECK	MAX 70ms	MAX 25ms	MAX 10ms	MAX 10ms	MAX 15ms	MAX 100ms	MAX 400ms
SRATE DOWN POINT SET(Note4)	MAX 70ms	MAX 40ms	MAX 18ms	MAX 15ms	MAX 35ms	MAX 330ms	MAX 3.3s

*Where, RESO is RESOLUTION value.

Note1: In case of URATE=DRATE setting, the command execution time in the Arithmetic Mode is almost the same as the one in the Fixed Mode, and there are little difference.
(The SENSOR INDEX3 DATA SET and The SERIAL INDEX CHECK Command is excluded.)

Note2: In case of URATE≠DRATE setting, command execution times vary greatly with parameters (drive type, LSPD, URATE, DRATE and RESOLUTION). The above table shows the worst dispersion, and they have the following tendencies: (The SERIAL INDEX CHECK Command is excluded.)

① The slower the LSPD, the longer the command execution time.

② In case of the same LSPD, the smaller the speed resolution (RESOLUTION) value, the longer the command execution time.
In the Fixed Mode, the command execution time becomes longer in the sequence of H, M and L.

③ As LSPD or RESOLUTION values make URATE or DRATE values larger, the command execution time may become shorter.

Note3: The execution time of the SERIAL INDEX CHECK Command varies with parameters (drive type, PART HSPD, URATE, DRATE and RESOLUTION), and the above table shows the worst dispersion.
These dispersion have the following tendencies:

① The larger the speed difference between check sections (difference between PART HSPD in the check section and PART HSPD in the section before), the longer the command execution time.

② When the speed difference is the same between check sections, the smaller the speed resolution (RESOLUTION), the longer the command execution time.
In the Fixed Mode, the command execution time become longer in the sequence of H, M and L.

Note 4: The SRATE DOWN POINT SET execution time depends on SHSPD as well. A greater SHSPD value means longer time. Values in the above table are based on the assumption that the SHSPD has the maximum value in each mode. If SHSPD = 1 MHz in the computation mode, the maximum 1 s is obtained if RESO = 1.

21. EXECUTION TIMES OF CALCULATION COMMAND

COMMAND NAME		Execution times						
		Fixed Mode			Arithmetic Mode			
		L-TYPE	M-TYPE	H-TYPE	RESO=255	RESO=100	RESO=10	RESO=1
SRATE DOWN POINT SET		MAX 100ms	MAX 40ms	MAX 18ms	MAX 15ms	MAX 35ms	MAX 330ms	MAX 3.3s
DRIVE CALCULATE	Acceleration Pulse	MAX 62ms	MAX 18ms	MAX 10ms	MAX 8ms	MAX 20ms	MAX 200ms	MAX 2.0s
	Acceleration time	MAX 72ms	MAX 28ms	MAX 12ms	MAX 10ms	MAX 24ms	MAX 232ms	MAX 2.3s
	drive time	MAX 120ms	MAX 48ms	MAX 20ms	MAX 16ms	MAX 40ms	MAX 400ms	MAX 3.3s
SRATE DRIVE CALCULATE	Acceleration Pulse	MAX 92ms	MAX 36ms	MAX 15ms	MAX 12ms	MAX 30ms	MAX 300ms	MAX 3.0s
	Acceleration time	MAX 100ms	MAX 40ms	MAX 16ms	MAX 13ms	MAX 33ms	MAX 330ms	MAX 3.3s
	Drive time	MAX 154ms	MAX 62ms	MAX 25ms	MAX 20ms	MAX 50ms	MAX 500ms	MAX 4.0s

*Where, RESO is RESOLUTION value.

Note 1: Each execution time depends on HSPD and SHSPD as well. A greater HSPD or SHSPD value means longer time. Values in the above Table are based on the assumption that the HSPD or SHSPD has the maximum value in each mode. When SHSPD = 1 MHz and RESO = 1 in the arithmetic mode, the maximum 1 s is obtained for the SRATE DOWN POINT SET, and the maximum 1.5 s is obtained for calculation of the acceleration pulse of the SRATE DRIVE CALCULATE .

Note 2: For DRIVE CALCULATE and SRATE DRIVE CALCULATE execution time there is almost no difference between the case where the constants in the acceleration/deceleration mode are equal, and the case where they are different.

Note 3: DRIVE CALCULATE and SRATE DRIVE CALCULATE execution time is scarcely affected by END PULSE, SEND PULSE and PEAK PULSE settings. DRIVE time calculation execution time in SRATE DRIVE CALCULATE is longer when the triangular drive workaround function is enabled. In this case, however, the above-mentioned maximum value is not exceeded.

Note 4: When the DRIVE time of SRATE DRIVE CALCULATE command is calculated under the condition of SURATE ≠ SDRATE, the execution time of the SRATE DOWN POINT SET command is added if the SRATE DOWN POINT SET command is not executed.

22. INITIAL SPECIFICATIONS

The following table shows initial specifications of basic and applied functions of MCC05v2 at POWER ON/RESET. If any specification has to be changed, use relevant Commands. When only basic functions are used, the specifications in Table 17-2. need not be considered. With some models, initial specifications marked with "Note" can be selected the no jumper on the some circuit board. Refer to respective USER'S MANUAL.

22-1. Basic Specifications

Data name or specification	Initial specification	Corresponding Command
URATE(RATE DATA TABLE No.)	No.9(100ms/1000Hz) (Note)	RATE SET
DRATE(RATE DATA TABLE No.)	No.9(100ms/1000Hz) (Note)	
LSPD	300Hz (Note)	LSPD SET
HSPD	3000Hz (Note)	HSPD SET
CSPD	300Hz (Note)	CSPD SET
SRATE(RATE DATA TABLE No.)	No.9(100ms/1000Hz) (Note)	SRATE SET
SLSPD	300Hz (Note)	SLSPD SET
SHSPD	3000Hz (Note)	SHSPD SET
DRIVE TYPE	L-TYPE	SPEC INITIALIZE1
LIMIT STOP TYPE	Fast stop	
MOTOR TYPE	Stepping	
RDYINT generation pattern	Generated only upon termination of a command accompanied by pulse output.	
PULSE COUNTER operating clock	MCC05v2 output pulse	PULSE COUNTER INITIALIZE
CNTINT generation pattern	Not generated in any case (all of COMP1 to 5)	
COMP1～5 STOP TYPE	Not put into stop (all of COMP1 to 5)	
AUTO CLEAR function	Not available	
RELOAD function	Not available	
PLS COMP STOP TYPE	Fast stop	
CNTINT OUTPUT TYPE	Detection of each comparator is latched and output	
CNTINT LATCH TRIGGER TYPE	Level latch	
DIFFERENTIAL COUNTER operating clock	Difference between MCC05v2 output pulse and an external clock.	DFL COUNTER INITIALIZE
DIFFERENTIAL COUNTER count pattern type	Clock with 90°phase difference 1 multiplication	
DFLINT generation pattern	Not generated in any case (both of COMP1 to 2)	
DFL COMP1,2 STOP ENABLE	Not put into stop (both of COMP1 to 5)	
DFL COMP STOP TYPE	Fast stop	
DFLINT OUTPUT TYPE	Detection of each comparator is latched and output	
DFLINT LATCH TRIGGER TYPE	Level latch	
COUNTER SELECT PORT	PULSE COUNTER	Each PORT SELECT
ADDRESS(ADDRESS COUNTER Value)	0	ADDRESS INITIALIZE
OFFSET PULSE	0	OFFSET PULSE SET
LIMIT DELAY TIME	300ms	ORIGIN DELAY SET
SCAN DELAY TIME	50ms	
JOG DELAY TIME	20ms	
PULSE COUNTER Value	0	PULSE COUNTER PRESET
PULSE COUNTER COMPARE REGISTER1～5 value	800000_H	PULSE COUNTER COMPARE REGISTER1～5 SET
DIFFERENTIAL COUNTER value	0	DFL COUNTER PRESET
DIFFERENTIAL COUNTER COMPARE REGISTER1～2 value	0	DFL COUNTER COMPARE REGISTER1～2 SET

22-2. Applied Specifications

When applied specifications are used, the following functions are added to the ones of the basic functions.

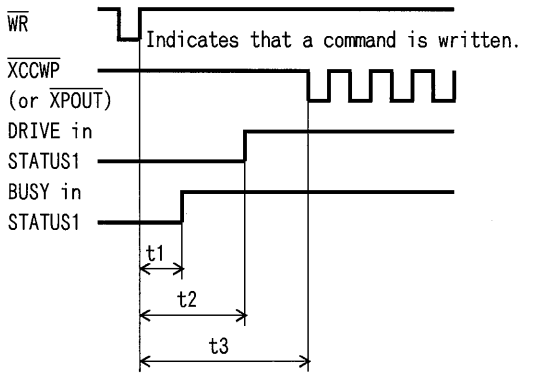
Data name or specification	Initial specification	Corresponding Command
ESPD,SESPD	300Hz (Note)	ESPD SET,SESPD SET
PART RATE1 to 10	No.9(100ms/1000Hz) (Note)	PART RATE SET
HSPD1 to 10 (PART HSPD)	No.9(100ms/1000Hz) (Note)	PART HSPD BUFFER SET, PART HSPD SET
PART PULSE1 to 10	0	PART PULSE SET
SPEED DATA setting method	Hz direct setting	SPEC INITIALIZE3
Pulse output type	Independent CW and CCW output	
First pulse width	100μs	
RESOLUTION	1	RESOLUTION SET
INCREMENTAL DATA	0	INCREMENTAL DATA SET
ABSOLUTE DATA	0	ABSOLUTE DATA SET
PEAK PULSE	2	PEAK PULSE SET
END PULSE	0	END/SEND PULSE SET
MARGIN TIME	0	ORG MARGIN TIME SET
ORIGIN DRIVE detecting direction	-(CCW) direction	SPEC INITIALIZE4
MCC03 MODE	Per basic specifications	
SOFT LIMIT function	Not use *1	
DEND ERROR detecting function	Not use *2	
CW SOFT LIMIT address	0 (As specified in *1)	CW SOFT LIMIT
CCW SOFT LIMIT address	0 (As specified in *1)	CCW SOFT LIMIT
DEND TIME	327.675s (As specified in *2)	DEND TIME SET
ORIGIN SENSOR TYPE	Edge	EXTEND ORIGIN SPEC
ORIGIN ERROR detecting function	Not use *3	
AUTO DRST output function	Not use	
PO input function	Not use	
JOG DRIVE MAX PULSE	255 (As specified in *3)	
CONSTANT SCAN DRIVE MAX PULSE	8,388,607 (As specified in *3)	CONSTANT SCAN MAX PULSE SET
DFLINT output	ORed output of comparator1 and 2	DFL COUNTER INITIALIZE
DIFFERENTIAL COUNTER detection	Detection in absolute value	
DFL COMPARATOR1 TYPE	DIFFERENTIAL COUNTER≧comparator1	
DFL COMPARATOR2 TYPE	DIFFERENTIAL COUNTER≦comparator2	
Division of input clock to DIFFERENTIAL COUNTER	Disabled	DFL DIVISION DATA SET
Asymmmetric S-RATE	Disabled	SPEC INITIALIZE5
TRIANGULAR DRIVE WORKAROUND	Disabled	
CHANGE speed increase	Disabled	
AUTO CHANGE	Disabled	

23. TIMING

$\overline{WR}$ shown with the following timing denotes an ISA bus signal.
It corresponds to the signal explained under IOW# in the User's Manual for PCI Bus Controller.
For the A-LINK, 0.3ms max (at 625000bps) is required from writing into the master board to writing into the MCC05V2.
Numerals in [] are based on the assumption that the SOFT LIMIT function is enabled.
Numerals without [] are independent of whether the SOFT LIMIT function is enabled or not.

23-1. SPECIAL SCAN1, 2 DRIVE Timing

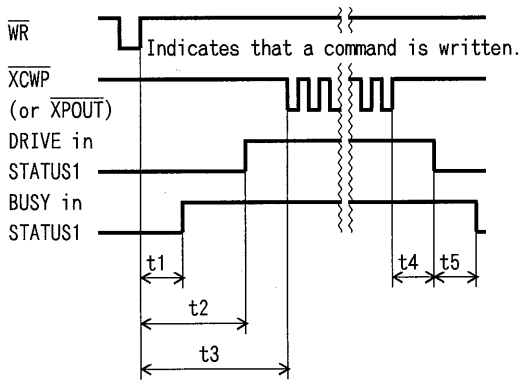
Example : Drive of stepping motor in the -(CCW) direction



t1<150ns
t2<38μs[75μs]
t3<50μs[90μs]

23-2. SPECIAL INDEX1, 2 DRIVE Timing

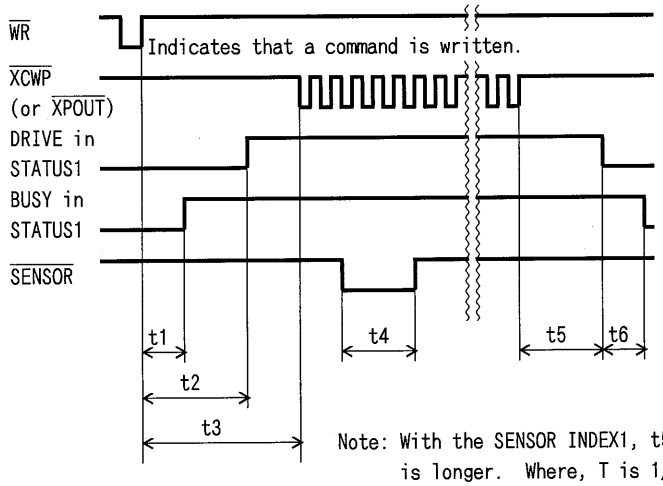
Example : Drive of stepping motor in the +(CW) direction



t1<150ns t4<30μs[38μs]
t2<68μs[77μs] t5<16μs
t3<83μs[92μs]

23-3. SENSOR INDEX1, 2 DRIVE Timing

Example : Drive of stepping motor in the +(CW) direction



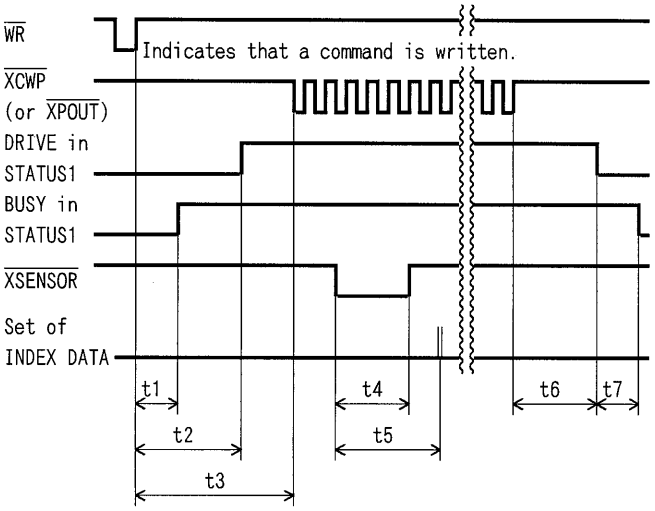
(1) When URATE=DRATE is specified.
t1<150ns t4>200μs
t2<67μs[85μs] t5<35μs(Note)
t3<81μs[99μs] [43μs]
t6<15μs

(2) When URATE≠DRATE is specified.
t1<150ns t4>200μs
t2<1.3ms (L-TYPE) t5<35μs(Note)
630μs(M-TYPE) [43μs]
400μs(H-TYPE) t6<15μs
32ms (Arithmetic Mode)
t3<t2+14μs

Note: With the SENSOR INDEX1, t5 takes either an indicated value or T whichever is longer. Where, T is 1/2 of the pulse cycle during stop.

23-4.SENSOR INDEX3 DRIVE Timing ®1

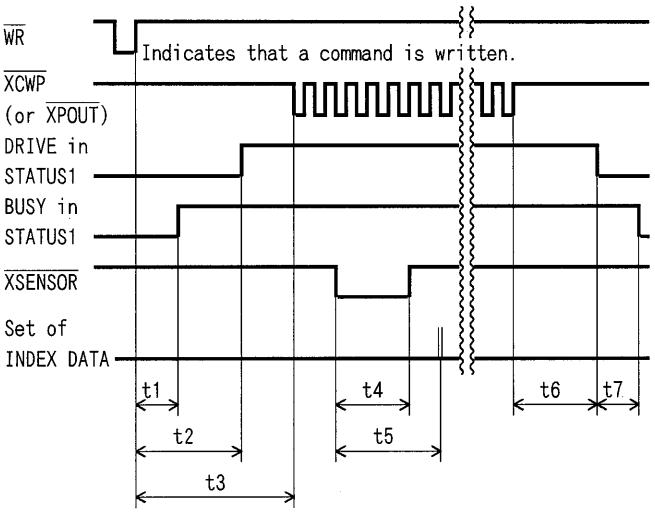
Example : Drive of stepping motor in the +(CW) direction



t1<150ns t4>200μs
t2<1.3ms (L-TYPE) t5<200μs
630μs(M-TYPE) t6<26μs
400μs(H-TYPE) [35μs]
32ms (Arithmetic Mode)
t3<t2+15μs t7<16μs

23-5.SENSOR SCAN1 DRIVE Timing

Example : DRIVE in +CW direction for the Stepping Motor without using a synchronization function



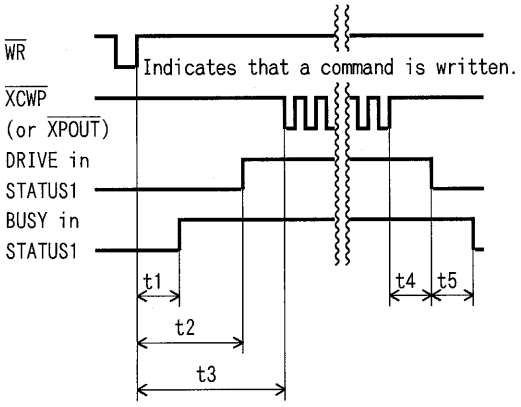
t1<150ns t4>200μs
t2<40μs t5<200μs + T
t3<26μs t6<32μs[42μs] (Note)
t7<20μs

T = 1/2 of the pulse cycle during stop

(Note) t6 corresponds to the displayed numeral or T, whichever is longer. Assume that the 1/2 of the pulse cycle when stopped is T.

23-6.SERIAL INDEX/SPECIAL SERIAL INDEX DRIVE Timing

Example : Drive of stepping motor in the +(CW) direction.

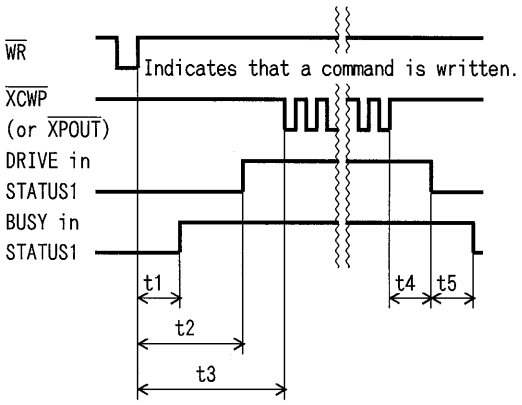


t1<150ns t4<27μs[35μs]
t2<47μs[56μs] t5<16μs
t3<62μs[71μs]

23-7. INDEX DRIVE Timing

Note that the timing in the arithmetic mode does not agree with the one mentioned in the User's Manual.

Example : Drive of stepping motor in the +(CW) direction.

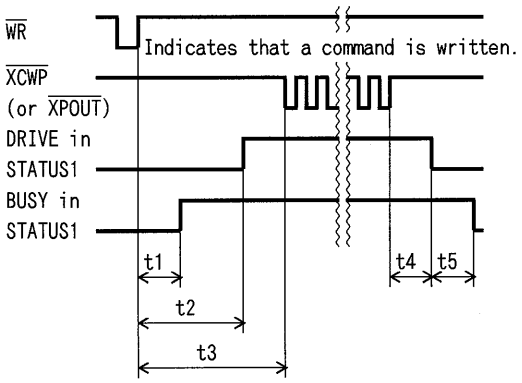


t1<150ns t4>35μs[44μs]
t2<71μs[79μs] t5<18μs
t3<93μs[101μs]

(2) When URATE≠DRATE is specified.
t1<150ns t4>35μs[44μs]
t2<1.3ms (L-TYPE) t5<18μs
630μs(M-TYPE)
400μs(H-TYPE)
32ms (Arithmetic Mode)
t3<t2+22μs

23-8. S-RATE INDEX DRIVE TIMING

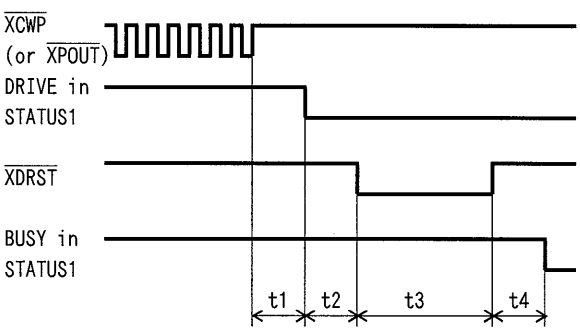
Example : DRIVE in +CW direction for the Stepping Motor without using a synchronization function



(1) When triangular drive workaround function is enabled
t1<150ns t4>33μs[40μs]
t2<95μs[104μs] t5<24μs
t3<20μs

(2) When asymmetric S-RATE DRIVE is enabled.
t1<150ns t4>33μs[40μs]
t2<1.3ms (L-TYPE) t5<24μs
600μs(M-TYPE)
380μs(H-TYPE)
32ms (Arithmetic Mode)
t3<14μs

23-9. Timing at the end of ORIGIN DRIVE that employs AUTO DRST Function

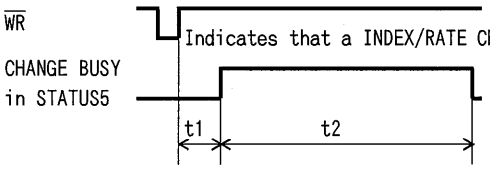


t1 and t2 are determined by a given ORG type.

When ORG-0,1,10 or 11
- t1≦58μs or a half period of CSPD
- t2≦22μs

When ORG-2,3,4,5 or 12
- t1≦22μs
- t2≒JOG DELAY TIME
- t3≒10ms
- t4<18μs

23-10. INDEX CHANGE, RATE CHANGE Timing



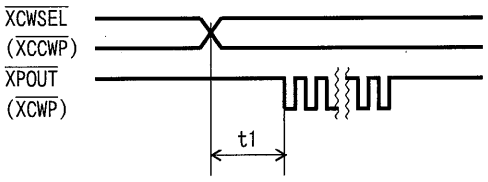
t1<200ns
51μs<t2<53ms(Note1)

Note1: t2 is determined by the RATE specified.
In the Fixed Mode, t2 becomes shorter as a greater RATE No. is specified. In the Arithmetic Mode, t2 becomes shorter as a smaller RATE is specified. In both cases, the rate of speed change grows larger.
However, if the pulse cycle is greater than t2 at the time when the CHANGE Command is written, t2 is equal with or greater than the pulse cycle.

Note2: When the INDEX CHANGE Command written during the END PULSE output, CHANGE BUSY is retained until the end of the drive. When the INDEX CHANGE is written during the SCAN DELAY TIME (for pausing), CHANGE BUSY is retained until a succeeding drive is started.

Note3: When the INDEX CHANGE Command is written during deceleration drive with the SLSTOP, CHANGE BUSY BIT is retained until current drive comes to the end.

23-11. When pulse output type is changed to direction designation output



In jog drive ····· t1>10μs

In other drives ····· t1>25μs

24. TROUBLESHOOTING

This chapter describes probable types of trouble and check points for them in using applied functions.

	Symptom	Check point
1	*Even if the SPECIAL INDEX DRIVE starts, no pulse is output. At the time, the STATUS1 ERROR BIT is set to 1. (Limit signal are normal.)	*Have URATE≠DRATE set? In this case, a command error will occur and no drive is possible.
2	*Even if the SERIAL INDEX DRIVE starts, no pulse is output. At the time, the STATUS1 ERROR BIT is set to 1. (Limit signal are normal.)	*When the pulse number in Section 1 is smaller than the specified pulse number, a command error will occur and no drive is possible. For the detail, see 3-5.
3	*Speed data are being read, but data seems to be out of order.	*Is the selected speed data setting method the same as the designated data contents? Note that data contents at the speed setting vary with the speed data setting method selected by the SPEC INITIALIZE3. *Are you trying to read very slow speeds such as data longer than 3byte? Speed data of very slow speed below 9.5Hz cannot be read.
4	*Acceleration/Deceleration time constants seem to be different from the set points of URATE and DRATE.	*Is the selected drive type the same as the specified data contents? Data contents at the rate setting time vary with drive type selected by the SPEC INITIALIZE1. Take notice of this. *When the drive type is arithmetic mode, have you set the RESOLUTION DATA? It is necessary in the arithmetic mode to set the RESOLUTION DATA in addition to rate data. *Check if a RATE change has been conducted in the SCAN DRIVE. A RATE change can affect a URATE or DRATE in the current drive.
5	*Output pulse is output only to the $\overline{CWP}$ output pin.	*Isn't the pulse output type the direction specified output? When the pulse output type is set to the direction designation type for the SPEC INITIALIZE3 Command, the $\overline{CWP}$ output becomes the pulse output terminal common to the both directions. For the detail, see 15-10.
6	*Specified HSPD is unobtainable.	*When the SENSOR INDEX2 DRIVE is selected, make sure that the SENSOR signal has not been turned on before the HSPD is started. *When the SENSOR INDEX3 DRIVE is selected, make sure that sufficient pulse number has been specified. See 3-9 for the detail. *When the INDEX DIVE is selected, make sure that the INDEX DRIVE has not been executed before the HSPD is started. Also, make sure that a triangular drive is not resulting from insufficient indexing.

	Symptom	Check point
7	*LSPD output duration is excessive.	*When the SOFT LIMIT is enabled in the SCAN DRIVE, make sure that you have not executed the rate change. *When the SENSOR INDEX2 DRIVE is selected, make sure that you have not turned on the SENSOR signal. *When the INDEX or S-RATE INDEX is selected, make sure that you have not set the end pulse.
8	*Drive comes to stop without undergoing the LSPD.	*When the SOFT LIMIT is enabled in the SCAN DRIVE, make sure that you have not executed the rate change. Also, make sure that you have not executed the speed change when URATE=/DRATE is specified.
9	*SENSOR INDEX3 Command is inoperable.	*Make sure that you have executed the SENSOR INDEX3 DATA SET Command.
10	*DIFFERENTIAL COUNTER indicates a larger/smaller value than the anticipated value.	*Executing the DFL DIVISION DATA SET Command resets the currently operation DIFFERENTIAL COUNTER (as specified in the POWER ON/RESET) to 0. Once measurement has been started, don't try to execute the DIVISION DATA SET Command.
11	*CNTINT or DFLINT is not available	*Make sure that INT MASK has not been enabled (the DFLINT is set to MASK at POWER ON/RESET). *Is appropriate setting provided for the COMPARE REGISTER , COUNTER INITIALIZE and such? *When the SOFT LIMIT is enabled, make sure that you have not set an off-the-limit value to the COMPARE REGISTER.
12	*DFLINT is generated for an excessively deviated positioning, too.	*Check the COMPARE REGISTER 2^{23} BIT for correct setup. Whenever detection is done in absolute value, 0 must be set on 2^{23}. In the absolute value detection approach, an absolute value on the DIFFERENTIAL COUNTER is compared against the value on the COMPARE REGISTER. When signed numbers are used for the detection, a value on the DIFFERENTIAL COUNTER is compared against that on the COMPARE REGISTER without converting it to an absolute value. *Check if both of DFL COMPARE REGISTER 1 and 2 have been enabled. DFLINT is OR of DFL COMPARE REGISTER 1 and 2 (in some setup AND of them). Thus, if you enable both registers, you cannot discriminate excessive deviation from positioning complete, or vice versa. This discrimination, by the way, is possible from the STATUS3 PORT.
13	*Drive is not available up to the specified pulse number	*Make sure that you have not enabled the SOFT LIMIT.
14	*Drive speed is slowed down as it approaches the SOFT LIMIT	*The SOFT LIMIT is not for decelerating the drive from that point on, rather it is intended for preventing the drive to continue beyond the set limit.

	Symptom	Check point
1 5	*S-RATE INDEX DRIVE cannot be started when the asymmetric S-RATE DRIVE function is enabled. In this case, the error bit in the STATUS is "1". (ERROR CODE =0CH)	*Have you executed the SRATE DOWN POINT SET command before DRIVE? When the asymmetric S-RATE DRIVE function is enabled, the SRATE DOWN POINT SET command must be executed in order to change the DRIVE parameter and to execute S-RATE DRIVE. Refer to the description of Chapter 14.
1 6	*The SPEED or RATE changes automatically after the DRIVE is started in SCAN or INDEX DRIVE mode.	*Have you enabled the AUTO CHANGE function by the SPEC INITIALIZE5 command?
1 7	*DRIVE changes other than the specified ones appear to have been performed with using AUTO CHANGE function that DRIVE shape is changed by.	The AUTO CHANGE function allows a total of 32 points to be specified. To prohibit unwanted changes, it is necessary to give a CHANGE disable instruction to the change point next to the final change point. If this is neglected, undefined changes may be performed. For details, refer to the description of 19-43.
1 8	*If the triangular drive workaround function is used, DRIVE timer is longer than when it is not used, in some cases.	*If the TOP SPEED is rounded by the triangular drive workaround function, the maximum speed becomes lower than when it is not used. This makes the DRIVE timer longer. However, the DRIVE time does not change when the DRIVE reaches the SHSPD, even if the triangular drive workaround function is enabled.
1 9	*The DRIVE is not stopped by slow top command (SLSTOP).	*Have you executed SENSOR SCAN1 command ?

The main parts which revised by this manual

Parts	Content
P16	【R6】 Added to Note 7 to chapter 3-11 「INDEX CHANGE Function During Drive」 Notes: 7. INDEX CHANGE of one INDEX DRIVE to reverse is up to once. ※If you want to perform INDEX CHANGE to reverse repeatedly, Please Contact us.

R4

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