Failure Notice for Fixed pulse driving in S-curve acceleration/deceleration

Nov.21 2006
NOVA electronics Inc.
Technical department

Items: Motion Control IC MCX302, MCX312, MCX304
Motion Control Board MC8080P, MC8082P, MC8082Pe, MC8042P and MC8022P.
*This failure doesn't occur on MCX501, MCX314As and MCX314AL.

[Symptom]

When using fixed pulse driving in S-curve acceleration/deceleration, if one of the following occasions ① to ④ is taken just before finishing driving, pulse may be continuously outputted depending on the setting value of parameters.

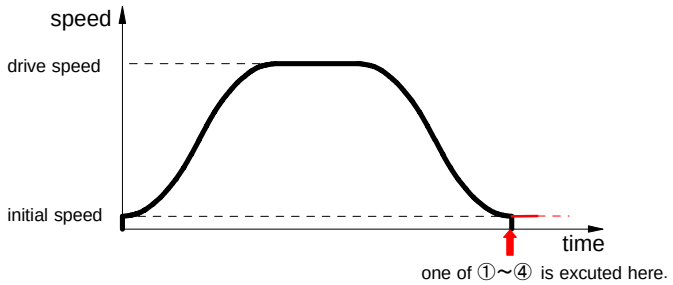


Figure 1. Speed profile of fixed pulse driving
in S-curve acceleration/deceleration

① When decelerating stop command (26h) was given just before finishing driving

② When setting stop mode of hardware limit (nLMTP/M signal) as decelerating stop (WR2/D2=1), driving is started and hardware limit of progress direction becomes active just before finishing driving

③ When software limit is enabled (WR2/D0, 1=1), driving is started and hardware limit of progress direction becomes active just before finishing driving

④ When nSTOP(2~0)signals are enabled(WR1/D5,3,1), fixed pulse driving is started and those signals become active just before finishing driving

- This trouble won't happen when trapezoidal (liner) acceleration/deceleration drive or constant speed drive is performed.

- This trouble won't be happened when continuous pulse driving in S-curve acceleration/deceleration.

- This trouble won't happen when any of Sudden stop command, EMGN signal, LMT signal of Sudden stop and ALARM signal is outputted.

Fixed pulse driving in S-curve acceleration/deceleration is performed as that driving speed and initial speed becomes equal and acceleration becomes zero (0) when driving finished, which means all pulse outputted. But it's impossible to make driving speed & initial speed equal and acceleration zero (0) in all combinations of parameters because of the problem of calculation accuracy. This trouble will happen if it is in the above mentioned occasion ①, ②, ③ or ④ as the factors of deceleration stop accidentally and driving speed hasn't reached initial speed yet but acceleration has become zero(0) showing on Figure 2.

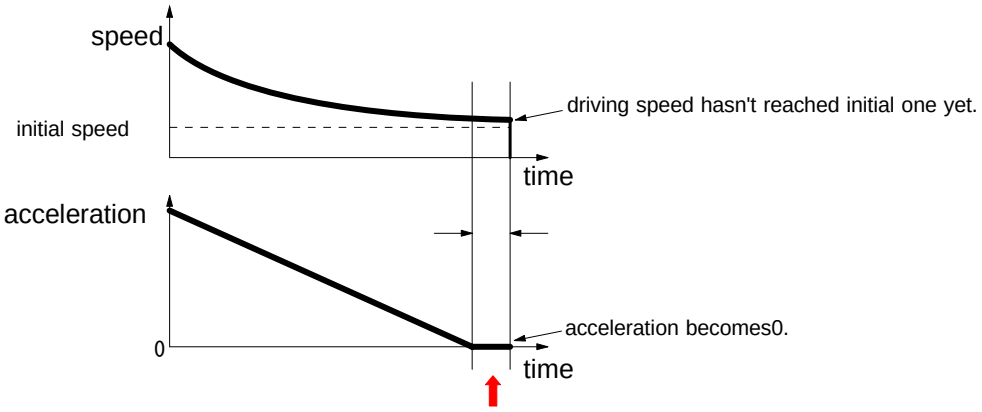
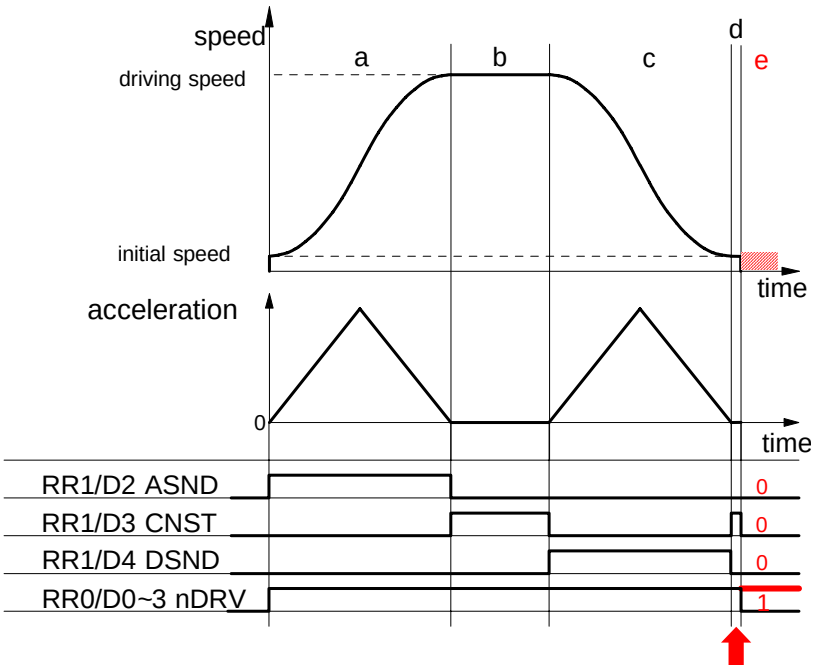


Figure 2. Driving speed and acceleration just before driving completion

Deceleration status of accelerating (ASND), constant speed driving (CNST) and decelerating (DSND) can be read out according to RR1 resister of IC. The status is shown as Figure 3. as below ;



The timing when the trouble may possibly happen is shown as “d” on Figure 3. At this time, status of deceleration is constant speed driving (CNST=1). Besides in case the trouble such as outputting pulse continuously happens, all of ASND, CNST and DSND will become 0 even though it’s driving (RR0/nDRV=1).

Figure 3. Status of deceleration shown by RR1 resister

［Workaround］

1　When deceleration stop command(26h) is executed【Case ①】

Basically once deceleration starts, it isn’t necessary to execute deceleration stop command. Therefore deceleration stop command should be prohibit. See nRR1/D4 (DSND) normally to know it’s decelerating or not. Timing when the trouble happens is in “d” as shown on Figure 3 if deceleration stop command is executed. In “d” DSND status bit is 0 and CNST status bit is 1.　Therefore the following two (2) solutions will be proposed.

(1) When interruption from IC can be used

When deceleration starts, interruption will be occurred to prohibit execution of deceleration stop command (26h) until driving completion. Flag of prohibition against deceleration stop command is prepared and it will be clear before driving starts. Enable constant speed area completion interruption (WR1/D13 (C-END)=1). Fixed pulse driving starts and if interruption is occurred, read RR3/D5 (C-END) within interruption process routine and status bit is 1, constant

speed area is completed which is same as deceleration starts. So make flag of prohibition against deceleration stop command 1. Besides it is possible that CNST (constant speed area) will occur just before driving completion. Then return WR1/D13 status bit from 1 to 0 in order to prevent interruption. On the other hand, within task, see flag and if it's 1, don't execute deceleration stop command.

(2) When interruption can't be used

Terms when deceleration stop command should be executed in accelerating and constant speed driving such as "a" and "b" on Figure 3. Status of deceleration for both "d" (timing when the trouble happens) and "b" (constant speed driving) is same as constant speed driving as shown on Figure 3. But there is difference of driving speed between two. Driving speed in "b" is near that of setting driving speed. Driving speed in "d" is near that of initial speed. Therefore before driving starts, prepare judgmental speed which is middle one between initial speed and setting speed ((Driving speed - initial speed)/2 + initial speed). When execute deceleration stop command during driving, make sure status is accelerating (ASND=1) or constant speed driving (CNST=1) and driving speed is same or faster than judgmental speed.

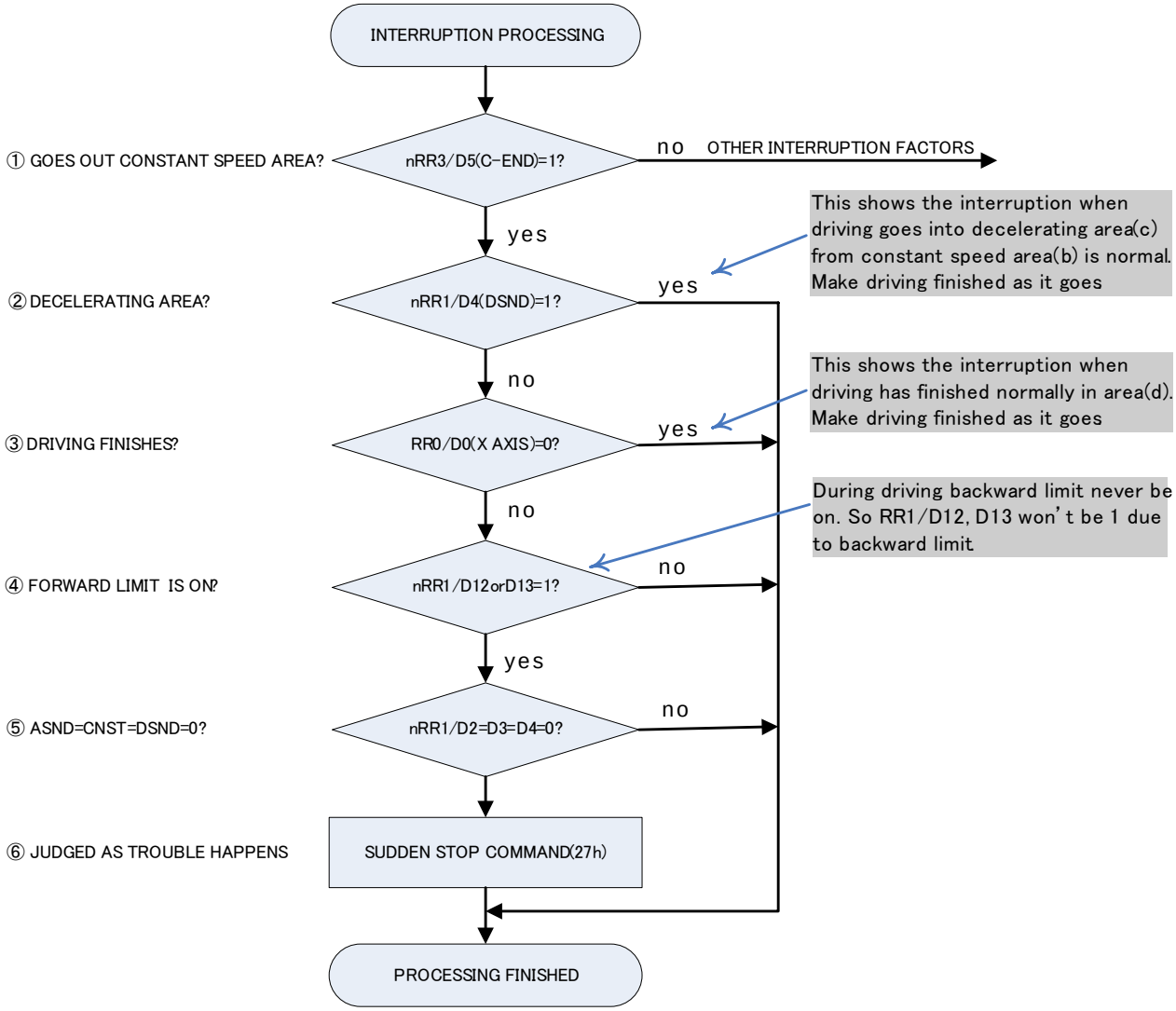
2 Hardware limit(nLMTP/M signal) at deceleration stop mode【Case ②】

Basically use hardware limit (nLMTP/M signal) at Sudden stop mode when fixed pulse driving in S-curve acceleration/deceleration. Out of necessity, when use hardware limit at deceleration stop mode, prepare the following measures. If multi-axes are controlled in the same time, (1) When interruption from IC can be used is effective.

(1) When interruption from IC can be used

Constant speed area ("b" area) on Figure 3 is set as occurrence factor of interruption. But this interruption is also happened when there is "d" area just before driving stops on Figure 3 such as when driving speed reaches initial speed or when acceleration becomes 0(zero). There should occur "d" area definitely if the trouble is happened just before driving stops, driving speed hasn't reached initial speed yet, acceleration becomes 0 and decelerating stop requirement is executed. The measure is to judge if the trouble happens or not in the timing of interruption when "d" area ends.

Make constant speed area finishing interruption of IC active (WR1/D13 (C-END)=1). Start fixed pulse driving in S-curve acceleration/deceleration and when interruption is happened, interruption processing is executed as follows;



① Check if driving goes out constant speed area or not. If RR3/D5 (C-END) bit of driving axis is 0, there are other interruption factors. Execute those interruption processing.

② Check if driving goes into decelerating area or not. If it's RR1/D4 (DSND)=1, make it finished as it goes because driving goes into "c" area from "b" area on Figure 3. If it's RR1/D4 (DSND)=0, move it to ③ processing because driving has gone out "d" area.

③ Check if driving has finished or not. If it's finished, make it finished as it goes because driving has finished normally. But if it's not finished yet, surely trouble have happened because status is shown as it's still driving even though driving has gone out "d" area.

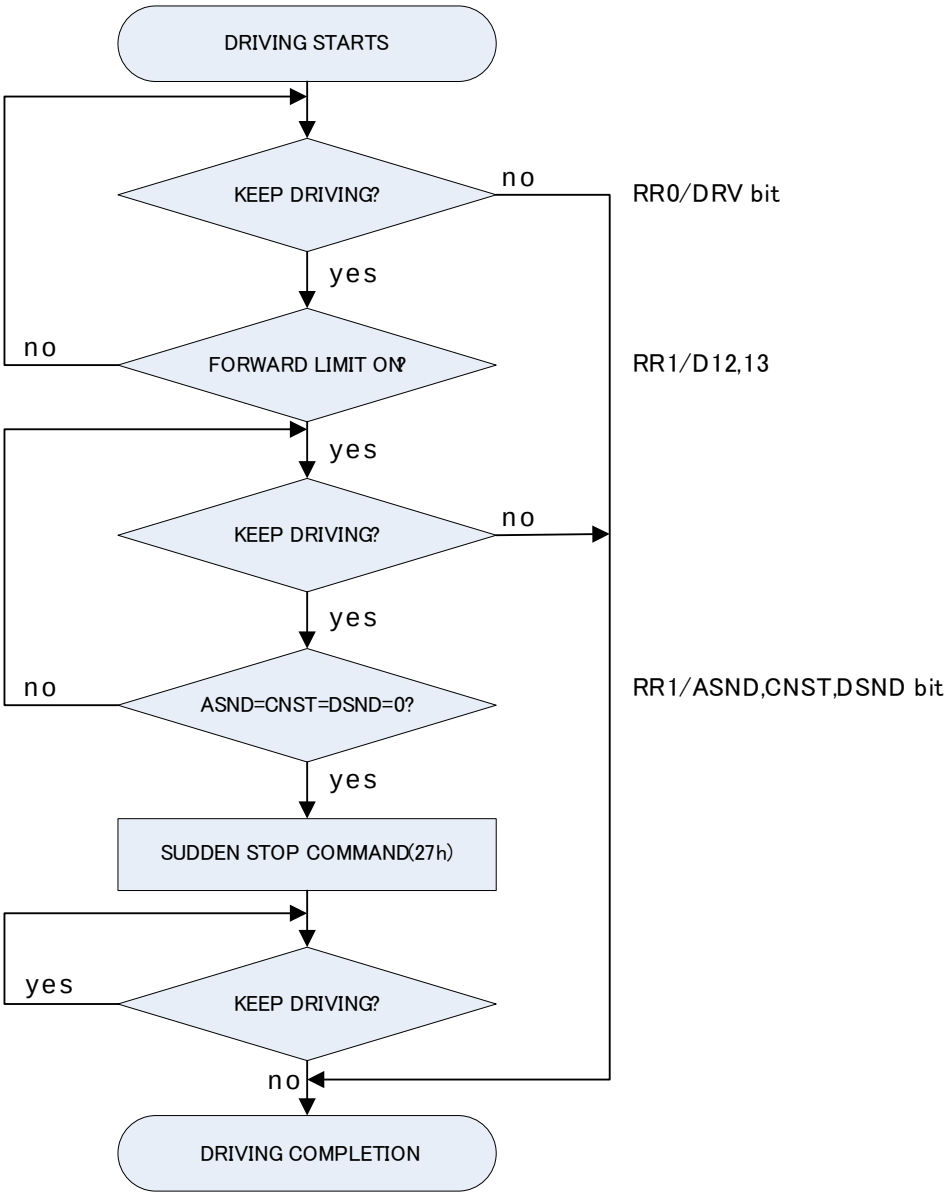
④ Check if hard limit is ON or OFF. Since RR1/D12 bit becomes 1 if + limit is ON and RR1/D13 bit becomes 1 if – limit is ON, if it's D12=1 or D13=1, judge forward limit is ON.

⑤ If trouble has happened, it becomes ASND=CNST=DSND=0. Check them all.

⑥ Execute sudden stop command (27h).

(2) When interruption can't be used

In "d" area on Figure 3, if forward limit is active, the trouble will happen, more exactly saying, it will seldom happen. There isn't any method to avoid it before it happens. So immediately after the trouble happens, take means to stop driving. If the trouble happens ("e" area on Figure 3), status keeps driving (RR0/nDRV=1), status of acceleration/deceleration is 0 in ASND, CNST, DSND. This is completely abnormal state. So the example of measure is shown as follows;



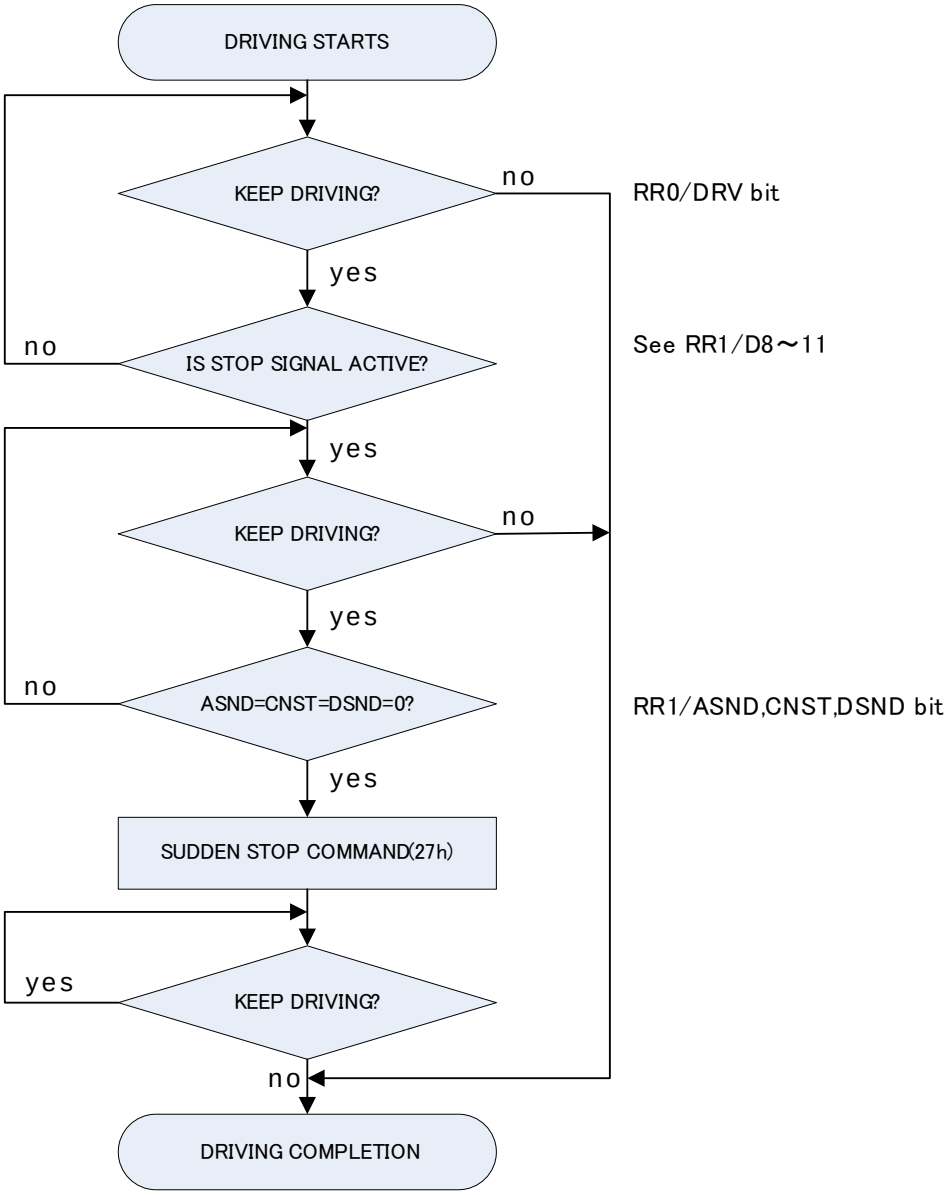
When start fixed pulse driving in S-curve acceleration/deceleration, always read out status of progress directional hardware limit (RR1/D12, D13) with timer interruption. If limit signal becomes active, read out bit status of ASND (D2), CNST (D3) and DSND (D4) in RR1 resister and execute sudden stop command (27h) one time only if all those 3 bits are 0.

3 Software limit【Case ③】

In fixed pulse driving, the target position (goal) can be calculated from present position (logical position counter value) and number of output pulse. If target position is over value of software limit, don't drive to avoid the trouble.

4　Deceleration stop with STOP(2～0) Signal【Case ④】

Normally deceleration stop with STOP(2～0)signal is performed during continuous pulse driving.
But out of necessity, when deceleration stop with STOP (IN) signal is performed during fixed pulse driving in S-curve deceleration, there isn't any method to avoid it before the trouble happens like chapter 2.2. So the example of measure is shown as follows;



If you need more assistance, please e-mail us at novaelec_info@novaelec.co.jp.