

1 . SPECIFICATIONS & FUNCTIONS

PPMC-111C/CFP

1 . SPECIFICATIONS & FUNCTIONS

1 - 1 Description

PPMC-111C/CFP is a programmable stepper motor control LSI developed to meet the varied needs of the times. It is an extension of the basic concepts of ampEre's **PPMC-100** series.

The most important function of a stepper motor controller is to perform accurate positioning control by smooth acceleration and deceleration. To that end, the controller must be able to set acceleration and deceleration curves best suited to the load and to freely control the output of high-speed and accurate drive pulses.

PPMC-111C/CFP is a control LSI that truly meets such requirements.

PPMC-111C/CFP offers three choices for acceleration and deceleration control, namely, "linear", "S-shaped" and "free-curve" acceleration/deceleration control methods. As a result, accurate positioning control is achieved by smooth acceleration and deceleration. Also, the capability for pulse output control of up to 66.67kpps enables instantaneous speed change during operation or speed change by acceleration or deceleration.

The operation of **PPMC-111C/CFP** is controlled by a built-in program, and sophisticated control of a stepper motor is realized by simple command codes and data given from the host processor. Thus the burden on the host processor is greatly reduced.

Furthermore, **PPMC-111** is available in two types -- **PPMC-111C** employing 64-pin shrink DIP package and **PPMC-111CFP** employing 64-pin QFP package. Therefore, they find applications in all sorts of products manufactured in small-volume production by manual assembly or in space-saving mass production.

1. SPECIFICATIONS & FUNCTIONS

PPMC-111C/CFP

1 - 2 Specification

Initialization function

Acceleration/deceleration parameters (starting speed, high speed, number of acceleration/deceleration pulses)

Acceleration/deceleration methods (linear, S-shaped, free-curve)

Operation control function

Acceleration/deceleration operation

Constant speed operation

Single step

Constant speed origin search (constant speed movement to base point)

Continuous constant speed operation (constant speed movement to limit)

Continuous high speed operation (high speed movement to high speed limit)

Instantaneous speed change, Accelerating/decelerating speed change

Emergency stop, Decelerating stop

Status read

Finish status

Command error code

Current position

Control input signal status

Auxiliary input signal status

Auxiliary control function

Current position setting

High speed limit effective speed limit setting

Auxiliary output

Pulse output frequency

31ppS to 66.67kppS (1 time mode selection)

8ppS to 16.67kppS (1/4 time mode selection)

2ppS to 4.17kppS (1/16 time mode selection)

Number of acceleration/deceleration pulses

8 to 65,535 pulses

Maximum number of output pulses

16,777,215 pulses

* Infinite operation in constant speed origin search or continuous operation command

Current position counter

3 bytes (000000h to FFFFFFFh)

Package

PPMC-111C 64-pin shrink DIP

PPMC-111CFP 64-pin QFP

1. SPECIFICATIONS & FUNCTIONS

PPMC-111C/CFP

1 - 3 Concepts & performance of PPMC-111

1 - 3 - 1 Pulse rate and motor speed

PPMC-111 uses the value called pulse rate as data to determine the speed of the stepper motor. The relationship between pulse rate and motor speed is as expressed by **Equation 1-1**:

$$\text{Speed} = \frac{\text{Tclock}}{\text{Rate}} \quad (\text{pps}) \text{ --- Equation 1-1}$$

where

Speed : Motor speed (pps, pulses/sec)
Tclock : Reference clock (selectable from 1MHz, 1/4MHz, 1/16MHz)
Rate : Pulse rate

1 - 3 - 2 Acceleration/deceleration methods

The acceleration/deceleration control of **PPMC-111**, which is determined by the data sent by the host processor, can be selected from the following three methods:

- (1) Linear acceleration/deceleration method
- (2) S-shaped acceleration/deceleration method
- (3) Free-curve acceleration/deceleration method

1 - 3 - 2 - 1 Linear acceleration/deceleration method

In the linear acceleration/deceleration method, the relationship between the pulse output speed and time during acceleration and deceleration is linear:

$$V = V_0 + K \times t \text{ --- Equation 1-2}$$

where

V : Velocity
t : Time
V₀, K : Constant

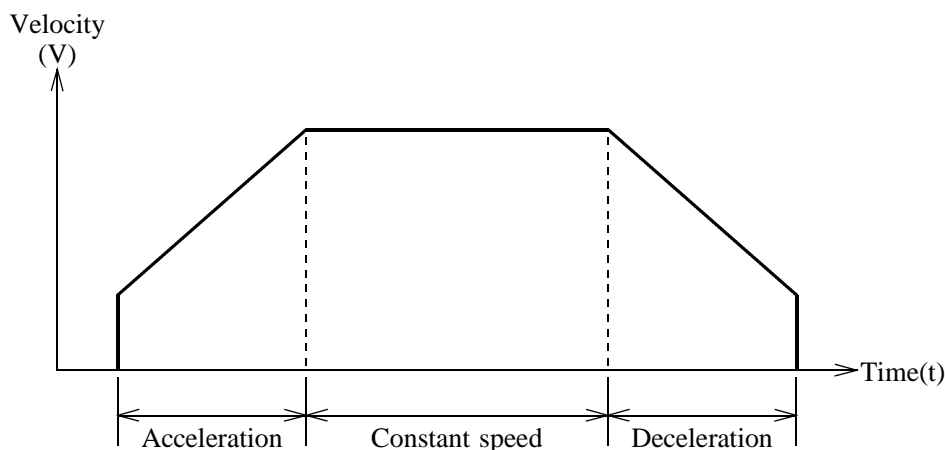


Fig. 1 - 1

1. SPECIFICATIONS & FUNCTIONS

PPMC-111C/CFP

1 - 3 - 2 - 2 S-shaped acceleration/deceleration method

In the S-shaped acceleration/deceleration method, the relationship between the pulse output speed and time during acceleration and deceleration is expressed as a "sine curve":

$$V = f(t) \text{ ---- Equation 1-3}$$

where

V : Velocity

t : Time

PPMC-111 uses the $f(t)$ of the equation as a sine function for S-shaped acceleration/deceleration control. By this method, smooth acceleration and deceleration realize accurate positioning control.

$$V = V_0 + K_1 \times (1 - \cos(K_2 \times t)) \text{ ---- Equation 1-4}$$

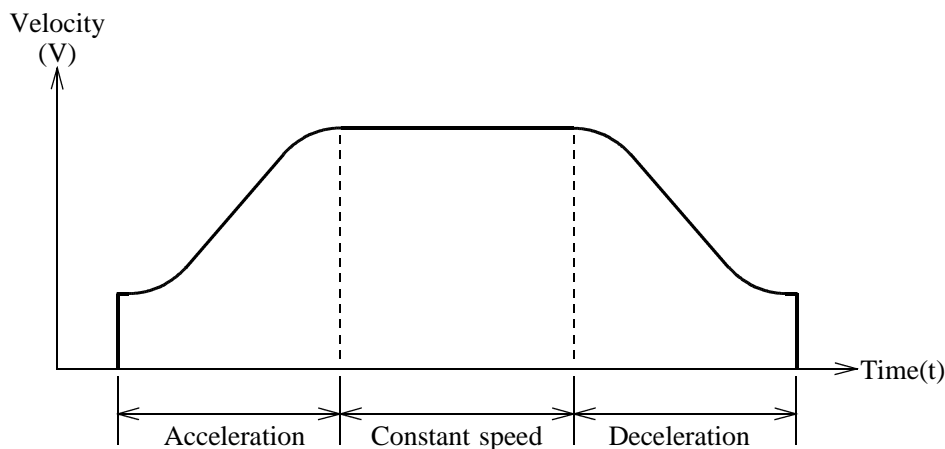


Fig. 1-2

1 - 3 - 2 - 3 Free-curve acceleration/deceleration method

The free-curve acceleration/deceleration method allows the user to create his own acceleration/deceleration curve by feeding data by himself.

1 - 4 Differences from PPMC-100 series

PPMC-111 retains the basic ideas of the former PPMC-100 series (PPMC-101C, 102A, 103A/AFP). Yet, designed to meet a wide range of contemporary and future needs, it has no interchangeability with the earlier series. The principal differences are as follows:

1 - 4 - 1 Addition of acceleration/deceleration methods and adjustment of acceleration/deceleration steps

In addition to the linear acceleration/deceleration method, which is the only method used with the PPMC-100 series, PPMC-111 offers two other choices, the "S" and "free-curve" methods. Also, PPMC-111 provides a maximum of 96 steps for acceleration/deceleration (32 steps with PPMC-101C and 102A, 44 steps with PPMC-103A/AFP) to accomplish smoother acceleration/deceleration operation.

1 . SPECIFICATIONS & FUNCTIONS

PPMC-111C/CFP

1 - 4 - 2 Higher speed

PPMC-111 is capable of delivering pulse trains at a maximum speed of 66.67kpps.

1 - 4 - 3 Addition of commands

For more meticulously controlled operation, PPMC-111 has more speed change commands and position setting commands.

1 - 4 - 4 Addition of error codes

With PPMC-111, if there is an error in the command code or data sent from the host processor, an error flag is set at the status register and the error code can be read by the "Command Error Read Command" for the reading of the internal register.

1 - 4 - 5 Elimination of phase excitation signals

PPMC-111 does not have phase excitation signals (S1 to S5), which the PPMC-100 series has.

1 - 4 - 6 Addition of status register bits

PPMC-111 has a number of additional status register bits so that the status of the PPMC-111 can be more closely monitored by the host processor.