Sil-Walker

PPMC-103A *New for 1990*

The **PPMC-103** is an improved, **CMOS** version of the PPMC-101/102 motor control IC. The use of CMOS over conventional NMOS reduces the power consumption from 625 mW (PPMC-101) to 150 mW for the PPMC-103. The command set is downward compatible with the PPMC-101/102 and adds three new functions. The PPMC-103 also increases the maximum pulse rate to **19K** pps and increases the smoothness of the acceleration/deceleration operation and increases the number of acceleration/deceleration steps to 11,220 max. (The PPMC-101/102 had a max of 8,160 accel/decel steps).

The major improvements are;

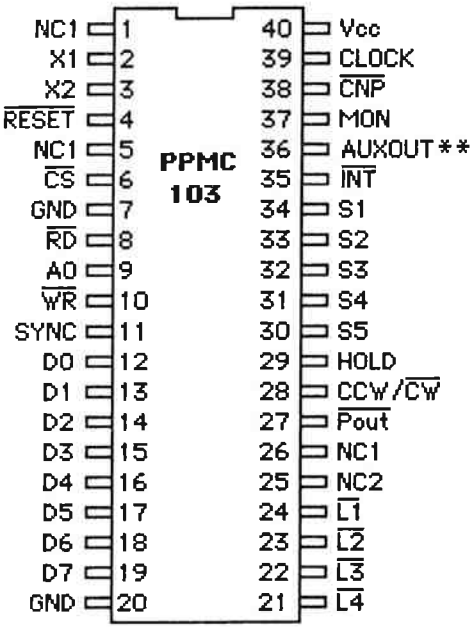
1 - Increase pulse rate to 19K pps maximum (P-out mode)
2 - Increase pulse rate to 12K pps maximum (phase outputs)
3 - CMOS technology. Decrease power consumption to 150 mW.
4 - Increase smoothness of acceleration/deceleration.
5 - Increase number of acceleration/deceleration steps to 11,220 max.
6 - Add a "SOFTWARE RESET COMMAND".
7 - Add an "AUXILIARY OUTPUT COMMAND" which controls the logic level
8 - Add a "SWITCHING RATE CONTROL COMMAND". This allows the duty cycle and the frequency of "EXCITATION SIGNAL SWITCHING" to be controlled by the user. This function is used to reduce power consumption of the motor at standstill by chopping the phase outputs, S1-S5.

The PPMC-103A is pin-compatible with the 101/102 versions, except that a previously unused pin (pin 36) is now used as an output. If this pin was left open or pulled up to 5V through a 3.3kΩ resistor (as per the manual) on designs using the 101/102, then the 103A can be substituted directly. Of course, the crystal must be upgraded to 12MHz for the 103A to give its' top performance.

When using the PPMC103A, substitute the following page 2 for the original page 2 appearing in the PPMC101/102 manual. All other pages should be treated as an addendum and inserted at the back of the manual.

Number of steps	:	16,777,216 max
Acceleration/Deceleration pulse number	:	4 - 11,220
Maximum pulse rate	:	19k pps (P-out mode, ext clock = 250KHz, RA = 13)
	:	12k pps (Phase outputs S1-S5, ext clock = 250KHz, RA = 20)
Power Supply	:	5 volts ± 10% 30 ma max with 12MHz x'tal **(CMOS)**

2. TERMINAL ASSIGNMENT AND FUNCTIONS



** AUXOUT, pin 36, was previously designated as unconnected in the PPMC-101/102.

SIGNAL	PIN *	I/O	DESCRIPTION
X1, X2	2, 3	I	Crystal inputs (12MHz max.)
RESET	4	I	RESET input, active low
CS	6	I	Chip Select input, active low
RD	8	I	Read strobe, active low
A0	9	I	Address 0
WR	10	I	Write strobe, active low
SYNC	11	O	Timing output
D0 - D7	12-19	I/O	Data Bus, 8-bits
L4	21	I	Reverse high-speed limit input
L3	22	I	Forward high-speed limit input
L2	23	I	Reverse absolute limit input
L1	24	I	Forward absolute limit input
P-out	27	O	Pulse output
CW/CCW	28	O	Direction output (forward/reverse)
HOLD	29	O	Motor status output
S5	30	O	Motor 5th phase output
S4	31	O	Motor 4th phase output
S3	32	O	Motor 3rd phase output
S2	33	O	Motor 2nd phase output
S1	34	O	Motor 1st phase output
INT	35	O	Interrupt output
AUX OUT	36	O	Auxiliary output (software controlled)
MON	37	I	External control of motor power '1' = Motor ON '0' = Motor OFF
CNP	38	I	Base point limit input
CLOCK	39	I	External clock input (250 KHz max)
Vcc	40	I	+5v DC power supply
GND	7, 20	I	Ground (0 volts)
NC1	1, 5, 26	I	Pull up to Vcc with 3.3K resistor
NC2	25	O	Leave this pin open (not connected)

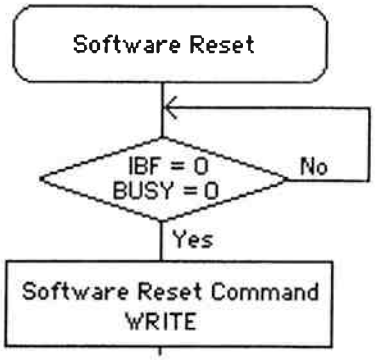
PPMC-103A COMMANDS

SOFTWARE RESET COMMAND

This is a NEW command, available on the PPMC-103A. This command causes a "RESET" of the PPMC with the same effect as a "hardware reset" (ie, the removal of power). After this command, the PPMC MUST be re-INITIALIZED. Any parameter in the "INITIALIZATION COMMAND" can be changed at this time. The "SOFTWARE RESET" will also cause all phase outputs, S1-S5, to turn off.

"SOFTWARE RESET" cannot be sent while the motor is in motion. The flowchart below must be followed.

7	6	5	4	3	2	1	0	
1	1	0	0	0	0	0	0	} Software Reset Command



AUXILIARY OUTPUT COMMAND

This command controls the logic level on pin 36. (On the PPMC-101/102, pin 36 is unused). This command can be sent at any time, even while the motor is running. Pin 36 assumes the appropriate logic level about 29 µsec after the command is sent. (12 MHz operation)

7	6	5	4	3	2	1	0	
1	1	0	0	0	0	0	1	} AUXILIARY OUTPUT "OFF" (pin 36 = 0)

7	6	5	4	3	2	1	0	
1	1	0	0	0	0	1	0	} AUXILIARY OUTPUT "ON" (pin 36 = 1)

SWITCHING TIME SETTING COMMAND

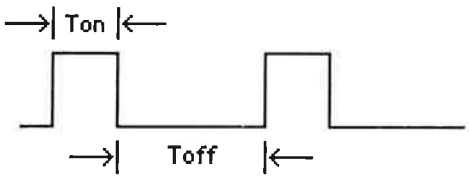
This new command allows programmable control over the frequency and duty cycle of the chopping of the "phase outputs", S1-S5, when the motor is at standstill. The "EXCITATION SIGNAL SWITCHING" bit must be set during "INITIALIZATION" to activate the phase chopping.

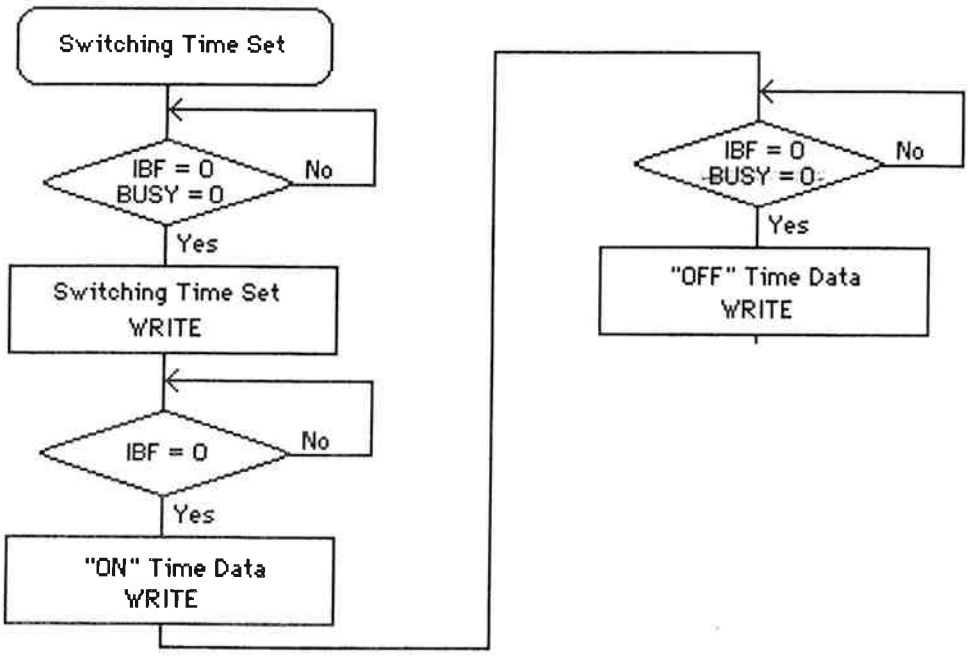
7	6	5	4	3	2	1	0	
1	0	0	0	0	1	0	0	Switching Time Set Command
								"ON" Time (Pon)
								"OFF" Time (Poff)

Ton = (Pon x 2.5) + 2.5 (μseconds)

Toff = (Poff x 2.5) + 28.75 (μseconds)

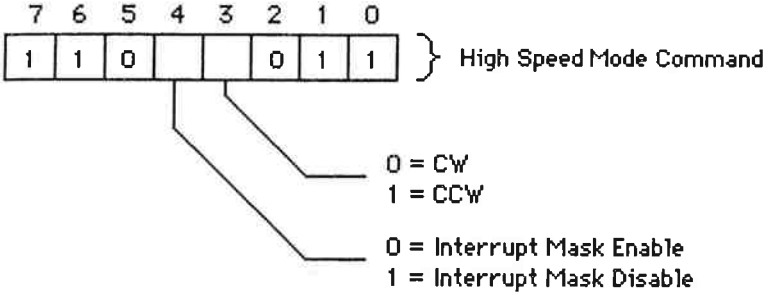
Switching Frequency = $\frac{1}{(\text{Ton} + \text{Toff})}$ (Hz)





HIGH SPEED MODE COMMAND (P-out only, Accel/Decel only)

This is a NEW command, to allow the P-OUT pulse rate to reach 19kpps. In this mode the "phase outputs", S1-S5 are disabled. The maximum pulse rate can only be achieved if the "external clock input", pin 39, is driven from the "SYNC" output, pin 11. With a 12 MHz crystal driving the PPMC-103A, the "SYNC" output = 800kHz. The maximum pulse rate is obtained when the external CLOCK input, pin 39, is driven at 266.67 kHz and RH = 13. The SYNC output must be divided by 3 to obtain 266.67kHz.

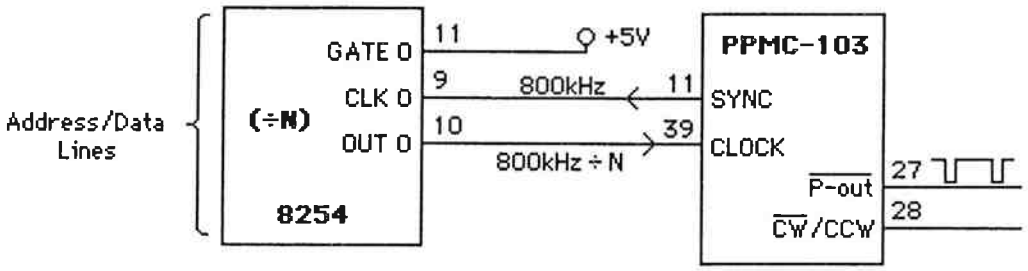


The flowchart for this command is identical to that of the Accel/Decel Command.

The output pulse rate (speed of motor) is calculated from the following formula;

$$\text{Speed} = \frac{10^6}{(RH + 1) \times (Tclock) + (7.5\mu sec.)} = \text{pulses-per-second} \quad \text{for } RH \geq 13$$

There are several ways to divide the SYNC output to levels useable by the PPMC-103A. The most versatile way is to use a programmable divider such as the INTEL CORP. 8254, which contains three 16 bit counter-timers. Programming the 8254 to divide by 3 gives (800kHz ÷ 3) = 266.67 kHz from SYNC output. Applying this to the CLOCK input at pin 39 will allow the maximum pulse rate of 19kHz. The beauty of using a software programmable divider is the wide range of speeds then available to the PPMC-103A. For example, using the 8254 (or any 16-bit divider), we can divide the SYNC clock by up to 65,536. This translates to a range of pulses-per-minute to 19k pulses-per-second.



Alternatively, a fixed divide-by-three circuit may be used where only the highest range of speeds is desired;