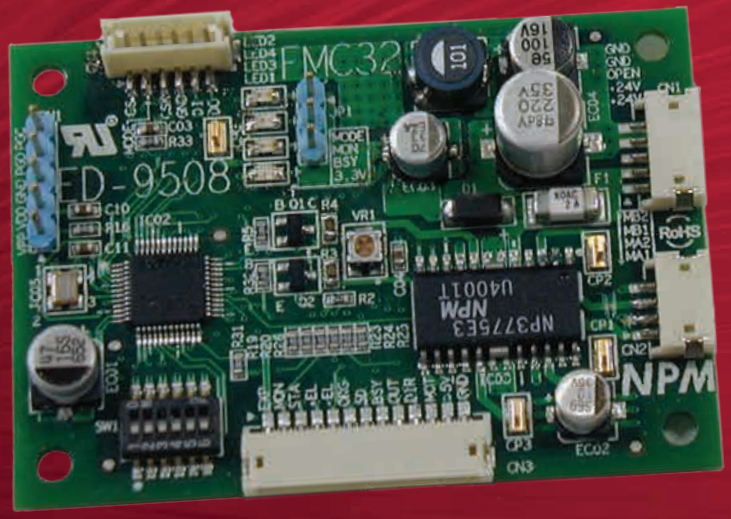
NIPPONPULSE.COM



Motion Control Electronics

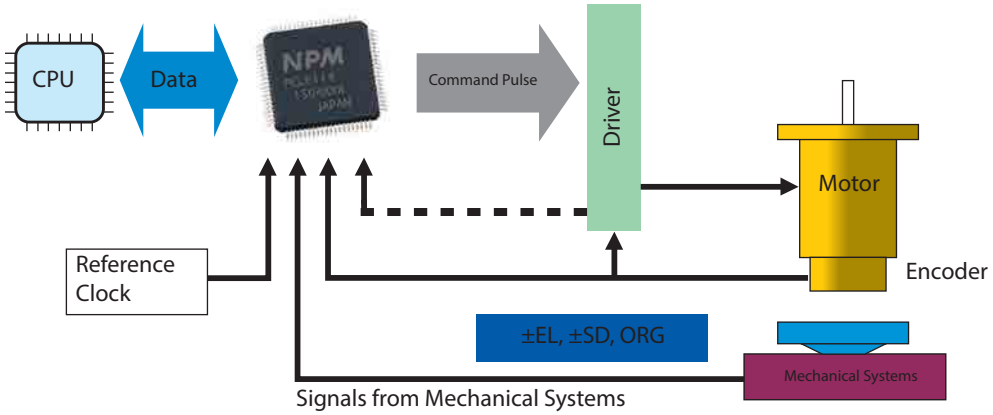
NPM Nippon Pulse
Your Partner in Motion Control

NIPPONPULSE.COM

Programmable Pulse Generators

PCL60xx Series **PCL61x3 Series** **PCL61x4 Series** **PCD2112** **PCD46x1A Series**

Receiving commands from a CPU, a programmable pulse generator can control a stepper motor or servomotor. The programmable pulse generator receives operating parameters for operating patterns from the CPU, and subsequently sends a START command. The motor control can then be committed to the chip, thereby reducing the burden to the CPU. Since Nippon Pulse first offered them in 1985, these programmable pulse generators have evolved, thanks in part to meeting the needs of our customers. These chips are available with a wide range of variations, including ultra-high-performance versions with interpolation functions, low-cost versions for simple motion control, and miniature versions.



Applications

Factory Automation	Semiconductor/Liquid Crystal Mfg.	Healthcare Equipment	Security & Office Automation
Injection molding machine	Exposure system	Blood analyzer	Security camera
Mounter	Membrane forming machine	Liquid injector	Entrance/exit checking machine
Laser processing	Etching machine	CT scanner	Parking management machine
Winding machine	Washing machine	MRI apparatus	Industrial printer
Dispenser	Probing machine	Biopsy instrument	Laser printer
X-Y stage	Dicing machine	X-ray generator	Labeling machine
Knitting machine	Bonding machine	Trial drug processor	Card conveyor
Paper processing	LSI tester	Pre-analysis processor	Bank ATM
Taping machine	Handler	Electronic microscope	Sorting machine
Food processing machine	Molding machine	Care & support instruments	Liquid handling instrument
Robot	Appearance inspection instrument		Amusement equipment
Packinging machine	Dimension measuring instrument		House automation equipment
Automatic soldering machine	Liquid crystal processing		

	PCL6046	PCL6045BL	PCL6025B	PCL6113 PCL6123 PCL6143	PCL6114 PCL6124 PCL6144	PCD2112	PCD4611A PCD4621A PCD4641A
KEY SPECIFICATIONS							
Max. Output Frequency (pps)	6,553,500	6,553,500	6,553,500	9,829,800	9,829,800	2,457,300	2,457,300
Number of Axes	4	4	2	6113: 1 6123: 2 6143: 4	6114: 1 6124: 2 6144: 4	1	4611A: 1 4621A: 2 4641A: 4
Motor Types:							
Stepper Motors	Y	Y	Y	Y	Y	Y	Y
Servo Motors	Y	Y	Y	Y	Y	Y	N
Package Type	208-pin BGA	176-pin QFP	128-pin QFP	6113: 80-pin QFP 6123: 128-pin QFP 6143: 176-pin QFP	6114: 80-pin QFP 6124: 128-pin QFP 6144: 176-pin QFP	48-pin QFP	4611A: 48-pin QFP 4621A: 64-pin QFP 4641A: 100-pin QFP
CPU Interface:							
8-bit Parallel	Y	Y	Y	Y	Y	N	Y
16-bit Parallel	Y	Y	Y	Y	Y	N	N
SPI Serial	N	N	N	N	N	Y	Y
Stand Alone Operation	N	N	N	N	N	Y	N
Programming Style:							
Direct Access to Registers	Y	N	N	N	Y	Y (Serial)	N
Indirect Access to Registers	Y	Y	Y	Y	Y (Parallel)	N	Y
Stand Alone with EEPROM	N	N	N	N	N	Y	N
KEY FUNCTIONS							
Operation Types:							
Built-in Homing	Y (13 types)	Y (13 types)	Y (13 types)	Y (2 types)	Y (2 types)	Y (3 types)	Y (3 types)
Continuous Operation	Y	Y	Y	Y	Y	Y	Y
External Encoder/Pulser Operation	Y	Y	Y	Y	Y	Y	N
External Position Override	Y	Y	Y	Y	Y	N	N
External Switch Operation	Y (Jog and Position)	Y (Jog and Position)	Y (Jog and Position)	Y (Jog and Position)	Y (Jog and Posi-tion)	Y (Jog and Position)	N
Positioning Operation	Y	Y	Y	Y	Y	Y	Y
External Simultaneous Start	Y	Y	Y	Y	Y	Y	Y
External Simultaneous Stop	Y	Y	Y	Y	Y	Y	Y
Timer Operation	Y	Y	Y	Y	Y	Y	Y
Interpolation:							
Linear	Y	Y	Y	6113: N 6123: Y 6143: Y	6114: N 6124: Y 6144: Y	N	N
Circular	Y	Y	Y	N	N	N	N
Spiral (Conical Cutting)	Y	Y	N	N	N	N	N
Continuous	Y	Y	Y	6113: N 6123: Y 6143: Y	6114: N 6124: Y 6144: Y	N	N
Acceleration/Deceleration:							
Linear Accel/Decel	Y	Y	Y	Y	Y	Y	Y
S-Curve Accel/Decel	Y	Y	Y	Y	Y	Y	Y
Modified S-Curve Accel/Decel	Y	Y	Y	Y	Y	Y	N
Accel/Decel Can Be Set Independently	Y	Y	Y	Y	Y	Y	N
Rampdown Setting Method	Automatic or Manual	Automatic or Manual	Automatic or Manual	Automatic or Manual	Automatic or Manual	Automatic or Manual	Automatic or Manual

Continued on next page...

	PCL6046	PCL6045BL	PCL6025B	PCL6113 PCL6123 PCL6143	PCL6114 PCL6124 PCL6144	PCD2112	PCD4611A PCD4621A PCD4641A
MAJOR EXTRA FUNCTIONS							
Simultaneous Start Pin	Y	Y	Y	Y	Y	Y	Y
Simultaneous Stop Pin	Y	Y	Y	Y	Y	Y	Y
Simultaneous Slow Down Pin	N	N	N	Y	Y	N	N
Synchronous Starting	Y	Y	Y	Y	Y	N	N
On-the-Fly Speed Change	Y	Y	Y	Y	Y	Y	Y
On-the-Fly Target Change	Y (2 types)	Y (2 types)	Y (2 types)	Y (2 types)	Y (2 types)	N	N
Idling Pulse Output	Y	Y	Y	N	N	N	Y
Triangle Drive Correction	Y	Y	Y	Y	Y	Y	N
Pre-Register (Look Ahead):	Y (2 layer)	Y (2 layer)	Y (2 layer)	Y (1 layer)	Y (1 layer)	N	N
Comparator Pre-Register	Y	Y	Y	N	N	N	N
Operation Pre-Register	Y	Y	Y	Y	Y	N	N
Vibration Suppression	Y	Y	Y	N	N	N	N
Backlash Correction	Y	Y	Y	N	N	N	N
Slip Correction	Y	Y	Y	N	N	N	N
Comparators:	Y (5)	Y (5)	Y (5)	Y (2)	Y (4)	N	N
Out of Step Correction	Y	Y	Y	N	N	N	N
Ring Count Function	Y	Y	Y	Y	Y	N	N
Software Limits	Y	Y	Y	N	Y	N	N
Synchronization Output	Y	Y	Y	N	N	N	N
Counters:							
Current Position Counter	Y	Y	Y	N	N	Y	Y
Deflection Counter	Y	Y	Y	N	N	N	N
General Purpose Counter	Y	Y	Y	Y	Y	N	N
Mechanical Position Counter	Y	Y	Y	N	N	N	N
INPUT/OUTPUT							
Excitation Sequencing Output:	N	N	N	N	N	Y	Y
Full Step	N	N	N	N	N	Y	Y
Half Step	N	N	N	N	N	Y	Y
Unipolar	N	N	N	N	N	Y	Y
Bipolar	N	N	N	N	N	Y	Y
Current Reduction Signal						Y	N
Pulse Output:							
CW/CCW	Y	Y	Y	Y	Y	Y	Y
Pulse and Direction	Y	Y	Y	Y	Y	Y	Y
90-Degree Phase Difference	Y	Y	Y	Y	Y	Y	N
Servomotor Interface:							
In Position	Y	Y	Y	Y	Y	Y	N
Error	Y	Y	Y	Y	Y	Y	N
Alarm	Y	Y	Y	Y	Y	N	N
Sensor Inputs:							
Home (ORG, EZ)	Y (ORG and EZ)	Y (ORG and EZ)	Y (ORG and EZ)	Y (ORG and EZ)	Y (ORG and EZ)	Y (ORG and EZ)	Y (ORG only)
End Limit(s)	Y (EL+, EL-)	Y (EL+, EL-)	Y (EL+, EL-)	Y (EL+, EL-)	Y (EL+, EL-)	Y (EL+, EL-)	Y (EL+, EL-)
Slow Down	Y (SD+, SD-)	Y	Y	Y	Y	Y	Y (SD+, SD-)

Continued on next page...

	PCL6046	PCL6045BL	PCL6025B	PCL6113 PCL6123 PCL6143	PCL6114 PCL6124 PCL6144	PCD2112	PCD4611A PCD4621A PCD4641A
General I/O	Y (up to 8 per axis)	Y (up to 8 per axis)	Y (up to 8 per axis)	Y (up to 8 per axis)	Y (up to 8 per axis; 16 if Serial I/F)	Y (2 I/O & 2O)	Y (up to 4 per axis)
Emergency Stop Input	Y	Y	Y	Y	Y	Y	N
Interrupt Output	Y	Y	Y	Y	Y	N	Y
Encoder Input:	Y	Y	Y	Y	Y	Y	N
Encoder Input (up to 4x multiplication)	Y	Y	Y	Y	Y	Y	N
Pulser Input	Y	Y	Y	Y	Y	Y	N
MAJOR SPECIFICATIONS							
Reference Clock Input (MHz)	19.6608	19.6608	19.6608	19.6608	19.6608	9.8304	4.9152
Speed Setting Range	16 bit	16 bit	16 bit	14 bit	14 bit	13 bit	13 bit
Accel/Decel Setting Range	16 bit	16 bit	16 bit	14 bit	16 bit	16 bit	16 bit
# of Speed Setting Registers	3 (FL, FH, FA)	3 (FL, FH, FA)	3 (FL, FH, FA)	2 (FL, FH)	2 (FL, FH)	3 (FL, FH1, FH2)	2 (FL, FH)
Positioning Pulse Setting Range	32 bit	28 bit	28 bit	28 bit	32 bit	28 bit	24 bit
Power Source	3.3V	3.3V	3.3V and 5V	3.3V	3.3V	3.3V	3.3V
5V Tolerant	Y	Y	Y	Y	Y	Y	Y
Package Size (mm)	12x12	24x24	20x14	6113: 12x12 6123: 20x14 6143L 24x24	6114: 12x12 6124: 14x14 6144: 24x24	7x7	4611A: 7x7 4621A: 10x10 4641A: ?????

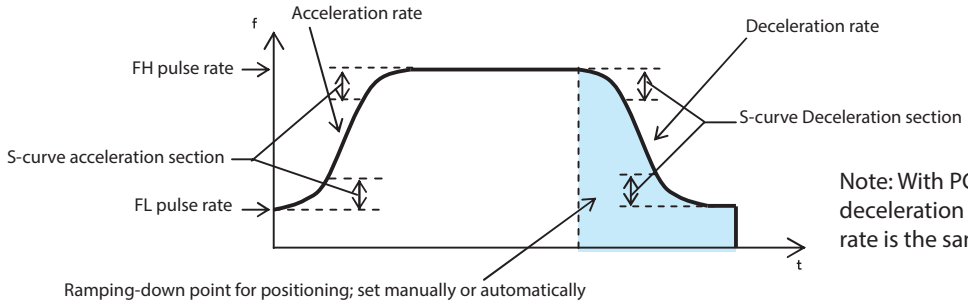
Notes on Specifications

Number of controllable axes	Number of axes a single chip can control
Reference clock	Frequency of the clock, which is programmed into the pulse generator. A frequency other than the standard can be entered, but the output pulse rate may be lower than decimal point.
Maximum output pulse rate	Maximum rate at which the chip can output pulses
Number of pulse rate setting registers	There are FL registers to which the starting pulse rate is written and FH registers to which the operating pulse rate is written. The operating pulse rate can be changed during the operation in progress by rewriting it
Number of pulse rate setting steps	Number of steps available for pulse rate setting. The more bits, the finer pulse rate possible
Pulse rate multiplication setting range	Output pulse rate is a product of the value of pulse rate register and of the multiplication setting
Acceleration rate setting range	Pulse rate slope at acceleration is set. Acceleration time can be calculated from the setting value.
Deceleration rate setting range	Pulse rate slope at deceleration is set. Deceleration time can be calculated from the setting value.
Number of positioning pulses setting range	Number of output pulses for positioning is set
CPU interface	Typical CPUs are stated in User's Manual
Ramping-down point setting range	Starting point of deceleration for positioning is set based on the number of remaining pulses

How to Determine Output Pulse Rate

Output Pulse Rate = Pulse Rate Register Value x Multiplication Register Value
The higher the pulse rate register value, the finer the output pulse rate can be set.

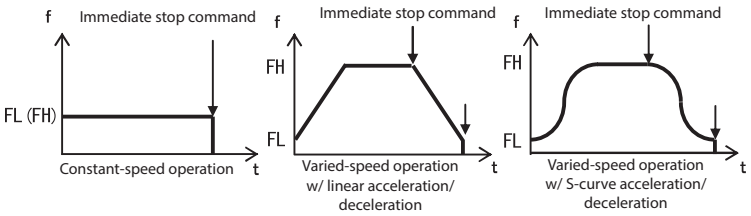
Pulse Output Pattern
Shown below is an example of S-curve acceleration/deceleration and S-curve section:



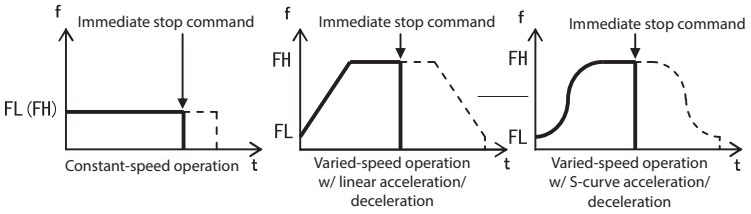
Note: With PCD46x1A series, S-curve acceleration/ deceleration sections cannot be set, and the deceleration rate is the same as the acceleration rate.

Typical Operation Profiles

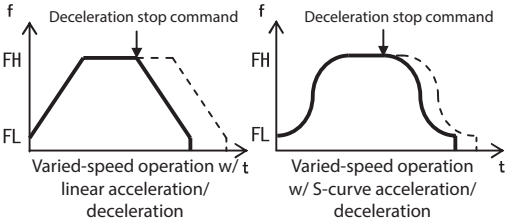
Preset Operation (Positioning)
The chip stops generation of pulses upon outputting a preset number



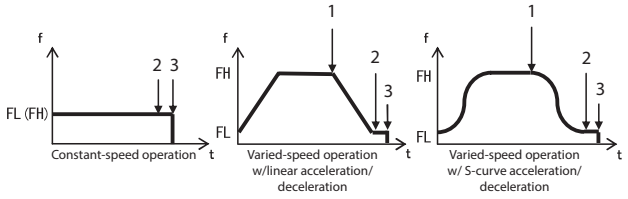
Immediate Stop
Immediate stop command stops the chip from outputting pulses irrespective of operating status.



Deceleration Stop
Deceleration-stop command lets the chip decelerate the pulse output and stop upon decelerating to the starting pulse rate.



Origin Return/Homing
Origin return sequence can be programmed using origin signal (ORG) ramping-down process signal (SD), end limit signal (EL) and encoder Z-phase signal. Listed below are typical origin return sequences in varied-speed operation.

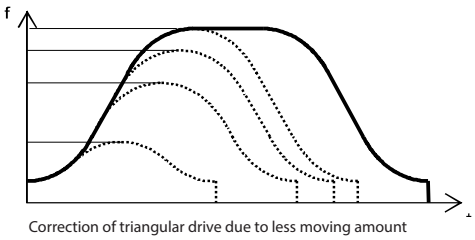


1. SD signal ON starts deceleration (1), and ORG signal ON stops pulse output (3).
2. SD signal ON starts Z-phase signal counting (2), and completion of counting stops pulse output (3).
3. ORG signal ON starts deceleration (1), and pulse rate output stops when decelerated to the FL pulse rate (3).
4. ORG signal ON starts deceleration and Z-phase signal counting (1), and completion of counting stops pulse output (3). PCL6000 series provides many other origin return sequences including those using EL signal. With PCD46x1A series, only the first and third sequences are applicable.

Triangular Drive Correction Function

Applicable models: PCL60xx, PCL61xx, PCD2112

When positioning and movement are minimal, this function automatically lowers the operating pulse rate (FH), thereby eliminating triangular drive and realizing a smooth pulse rate curve.

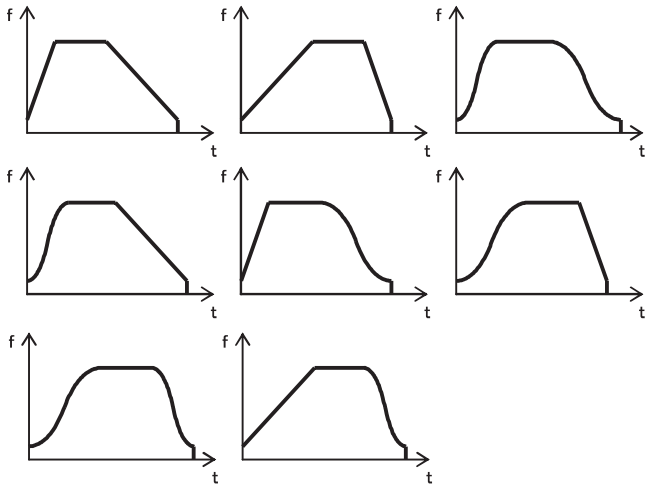


Correction of triangular drive due to less moving amount

Typical Acceleration/Deceleration Patterns

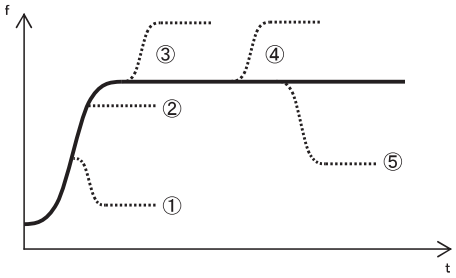
Applicable models: PCL6000, PCL6100, PCD2112

As shown below, various acceleration/deceleration patterns can be programmed.



Changing Pulse Output Pattern During Operation

(S-Curve acceleration/deceleration)



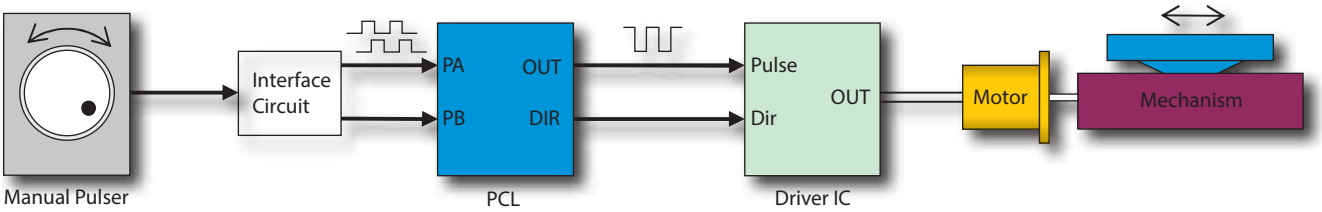
The preset FH register value can be changed to a lower value while acceleration is in progress.

1. If the newly set value is lower than the pulse rate at the time of the change, S-curve deceleration is made to the newly set value
2. If the newly set value is equal to or higher than the pulse rate at the time of the change, S-curve acceleration is made to the newly set value. Change the preset FH register value to a higher value during acceleration in progress.
3. S-curve acceleration is made to the preset pulse rate and then to the newly set value. Change the preset FH register value during operation at the FH rate in progress.
4. If the newly set value is higher than the preset FH register value, S-curve acceleration is made to the newly set value.
5. If the newly set value is lower than the preset FH register value, S-curve deceleration is made to the newly set value.

Pulser Input/External Input

Applicable models: PCL6000 series, PCL6100 series, PCD2112

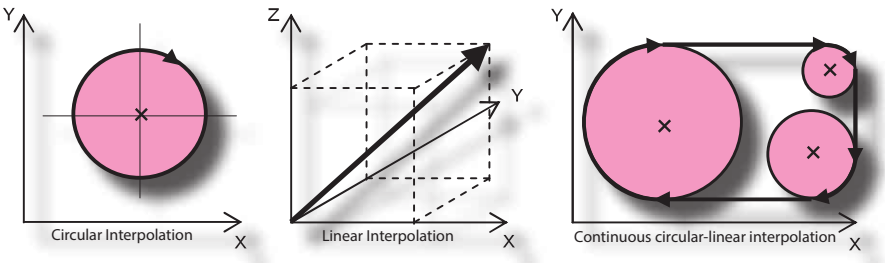
Receiving signal from a manual pulser, the programmable pulse generator outputs to the driver, the pulse signal corresponding to the rotating amount, and speed designated by manual pulse signal. If required, the present position can be controlled using the up/down counter. To prevent the stepping motor from running out-of-step, the operating speed (output pulse rate) can be restricted.



Interpolation

Applicable models: PCL6000 series, PCL series (linear interpolation only)

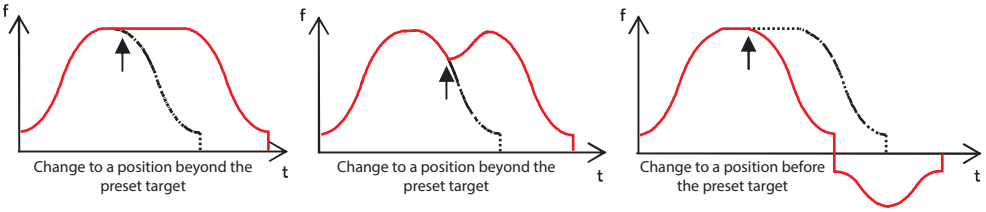
There are chips that provide both circular interpolation and linear interpolation functions and chips that provide only linear interpolation function. Models providing linear interpolation function enable interpolation in three dimensions. Models with circular and linear interpolation functions enable continuous circular-circular or linear-circular interpolation without cessation on the way.



Overriding Target Position

Applicable models: PCL6000 series, PCL6100 series

Target position can be changed during operation in progress.



Advanced Motion Controllers

PCL6025B (2-axis)

PCL6045BL (4-axis)

PCL6046 (4-axis)

Advanced functions in this series include linear/circular interpolation, overriding operating pulse rate and target position during operation, operation correction, backlash correction, suppression of vibration at cessation, programmed soft limit, direct input of operating switch, diversified origin return sequences, mechanical signal input and servomotor interface. These functions enable the user to easily configure a complicated motion control system.

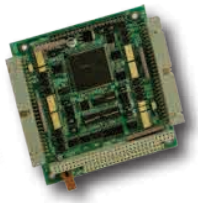
Features

- Circular interpolation between two desired axes and linear interpolation among two to four desired axes
  - Linear interpolation among five or more axes is also possible by using two or more chips (three or more axes for the PCL6025B)
- Preregisters enable continuous interpolation, circular-to-linear-to-circular
- Maximum output pulse rate: 6.5 Mpps (10 Mpps with PCL6046)
- Built-in four up/down counters per axis
  - PCL6046: 32-bit x 3 and 16-bit x 1; PCL6045BL/PCL6025B: 28-bit x 3 and 16-bit x 1
  - All counters can be used for various purposes since they can be latched or reset by signal input, conclusion of operation conditions, or the command
- Built-in five comparators per axis
  - PCL6046: 32-bit x 5; PCL6025B/PCL6045BL: 28-bit x 5
  - Use of comparators and counters in combination enables the following operations:
    - Interrupt signal output and external output of comparison results
    - Starting by internal synchronization signal
    - Immediate stop or deceleration-stop
    - Programmed limit
    - Out-of-step detection
    - Output of synchronization signal
    - Ring count function
- Overriding operating pulse rate and target position during operation in progress
  - Directly accessible to registers, not through input/output buffers (PCL6046 only)
  - 24 major operating modes
  - Two-stage preregisters are built in to permit writing parameters (moving amount, starting pulse rate, operating pulse rate, acceleration rate, deceleration rate, multiplication factor, ramping-down point, operating mode, center of circular interpolation, S-curve accel/decel) for the succeeding two operations during operation in progress
- Composite pulse rate in interpolated operation can be kept constant
- Manual pulser input terminal (with functions to multiply by 32 and to divide to 2048)
- Seventeen kinds of error factors and 20 kinds of event factors, any of which can initiate interrupt signal output (event factors can be selected by register)

PCL6045BL-mounted boards


PPCI-7443
Quadraxial Motion Control Board with PCI Bus

Pulse train output type; can control servomotor and stepper motor


NPMC6045A-4104
Quadraxial Motion Control Board with PC/104 Bus

Pulse train output type; can control servomotor and stepping motor

High Performance Servo/Stepper Controllers

PCL6113 (1-axis)

PCL6123 (2-axis)

PCL6143 (4-axis)

Because these chips have built-in preregisters (one stage), two up/down counters, per axis comparators, linear interpolation function, and servomotor interface, they can serve general motion control applications. This series is recommended for customers who need increased operational control that cannot be achieved with the PCD series. The maximum output pulse rate of 15 Mpps makes these chips compatible with high-resolution linear motors. There are also evaluation boards available that have the ability to reduce the number of development steps.

PCL61x3 Series Features

- Linear interpolation among two to four desired axes
  - Linear interpolation between chips is also possible
- Maximum output pulse rate: 15 Mpps
- Built-in two up/down counters per axis (28-bit)
- Built-in comparators per axis (28-bit)
  - Use of comparators and counters in combination enables the following operations:
    - Interrupt signal output and external output of comparison results
    - Ring count
    - Starting by internal synchronization signal
- Overriding operating pulse rate and target position during operation in progress
- Nine major operating modes
- One stage preregisters are built in to permit writing parameters (moving amount, starting pulse rate, operating pulse rate, acceleration rate, deceleration rate, multiplication factor, ramping-down point, operating mode center of circular interpolation, S-curve acceleration/deceleration sections) for the next operation during operation in progress
- Manual pulser input terminal (with no muliplier/divider function)
- 23 kinds of error and event factors, any of which can initiate interrupt signal output (event factors can be selected by register)

PCL6114 (1-axis)

PCL6124 (2-axis)

PCL6144 (4-axis)

This series has all the same features as the PCL61x3 series, but with available 8-bit and 16-bit data buses, among other improvements.

PCL61x4 Series Features

- Extended registers for position, speed, acceleration and deceleration
- Built-in two up/down counters per axis (32-bit)
- Built-in comparators per axis (32-bit)
- Programmable software limits (similar to PCL6000 series)
- Four more event factors to initiate interrupt signal output. Selectable by internal register.

PCD2112

Miniature Servo/Stepper Controller with SPI

RoHS

The first of its kind, this miniature package (mold measuring only 7x7mm) adopts a four-wire serial bus that enables downsizing of the board. It can output two-phase stepping motor excitation sequence and is equipped with a servomotor interface. The PCD2112 can control both stepper motors and servomotors.

Features

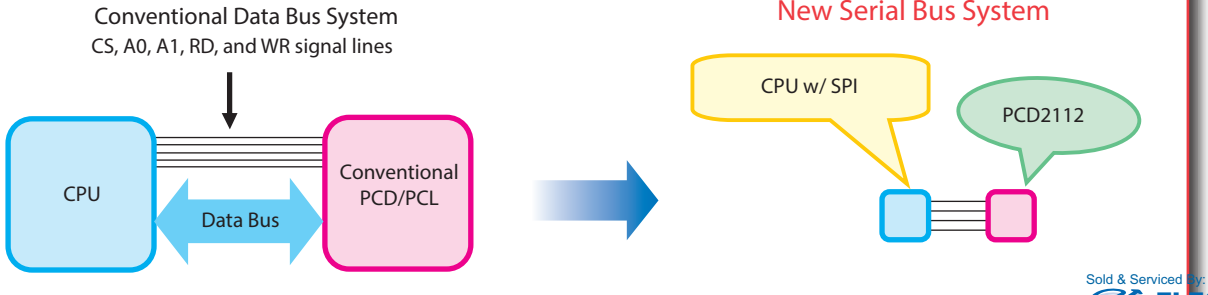
- Connection to CPU via four-wire serial bus
  - Usable with CPU, which is not provided with external bus terminal
  - General-purpose I/O terminals can effectively be used with CPU having multipurpose pins for external bus
- Optimized control parameter arrangement and block transfer
  - This enables reduction of transfer time to minimum
- Independent system mode for operation with no CPU
  - Operation with no CPU is made possible by externally connecting EEPROM in which up to 32 operating patterns are written
    - Maximum output pulse rate: 5Mpps (with reference clock 20MHz)
    - Pulse output mode: Selectable from 12 types of pulse signal outputs and two-phase stepping motor excitation sequence
    - 32-bit up/down counter built in
    - 11 major operating modes
    - Manual pulser input terminal (with no multiplier/divider function)
    - 11 factors are available to initiate interrupt signal output (event factors can be selected by register)
- Suitable for customers who want to:
  - Intelligently control the motor with a CPU with fewer pins
  - Make the motor control board smaller
  - Operate the chip like a stand-alone unit without a CPU connected at the time of operation
  - Enjoy more functions than provided by conventional PCD series

FMC32 Control Board

The FMC32, a compact controller with integrated driver, is equipped with a pulse control LSI PCD2112 for controlling a serial bus. Using the FMC32 board with a USB to 4-wire serial conversion unit (PUSB-3503), you can design a series of execution sequence programs and write the designed execution sequence program to the board. The designed execution sequence program can be verified and confirmed on the PC. Users are able to program up to 32 motion profiles with both linear and s-curve patterns.

By using control software, you can monitor the contents of all registers of the PCD2112 in real time. You can use this function to understand the PCD2112 thoroughly.

A CPU is equipped with the FMC32. You can repeat the execution sequence program written to the FMC 32 automatically. If you use a motor and a driver additionally, you can confirm operation in more detail. The FMC32 board has two operational modes, the PC control mode and the standalone control mode.



Economical Stepper Controllers


PCD4611A (1-axis)


PCD4621A (2-axis)


PCD4641A (4-axis)

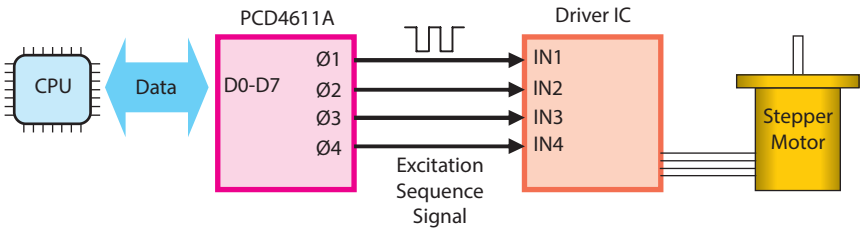
The PCD4600 series chips are low-cost, programmable pulse generators equipped with an excitation sequence generator circuit to drive two-phase stepper motors. Placing a stepper motor drive IC between the PCD and each stepper motor enables the user to easily configure a multi-axial motion control system. Each model can also output a pulse train.

Features

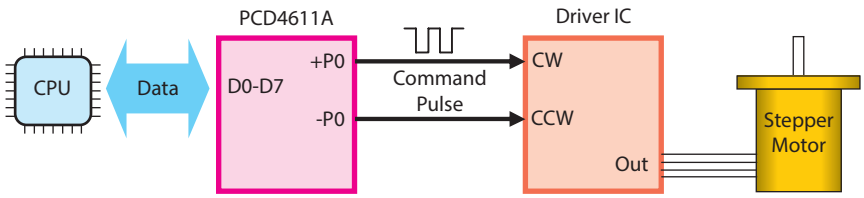
- Output pulse rate: 2.4 Mpps
  - Practical rate; theoretically max. 5 Mpps
- Linear and S-curve acceleration/deceleration
- Two-phase stepper motor excitation sequence circuit built-in
- Simultaneous start/stop
  - Pulse output on multiple axes within one chip or on multiple chips can be started simultaneously by the command or external signal. Pulse output on all axes can be stopped by the command, external signal, or failure on any axis.
  - Idling pulse output (1 to 7 pulses)
  - Overriding operating pulse rate during operation in progress
  - Four major operation modes

Connection Examples

1. Send Excitation Sequence Signals to a Driver IC.



2. For any Driver IC with a Built-In Excitation Sequence Circuit, Send a Pulse Train.



Function	Description
S-curve acceleration/deceleration	Pulse rate is accelerated or decelerated in S-curve, which enables reduction of mechanical vibration caused by conventional linear accel/decel. The degree of vibration suppression differs depending on conditions including the applied motor, mechanism and operating pattern
S-curve section setting	To shorten the S-curve accel/decel time, the S-curve can be made linear. Setting S-curve sections lets acceleration or deceleration be made in the S-curve at the start and end, with a linear section in the middle
Triangular drive correction function	When operated with parameters which cause triangular drive (abrupt change from accel to decel), operating pulse rate (FH) is automatically decreased to eliminate triangular drive
Origin return	Movement is made to the origin. Various origin return modes are available depending on models
Origin search, origin escape	Origin Search: Origin return is made from the designated direction while reciprocating between plus and minus end limits. Origin escape: When origin signal is ON, pulse output returns OFF position once. At that time, it can be stopped by counting encoder Z-phase signals
Origin return w/moving amount restricted	When origin signal is ON or when pulses are output in the number designated by the register, the chip stops outputting pulses
Limit positioning	Movement is made to mechanical or programmed end limit position, and then stops normally
Limit escape	Movement is made to limit OFF position from the mechanical or programmed end limit position
Servomotor interface	The following signals are available for servomotor control: 1. In-position: Until receiving in-position signal from servomotor drive, the chip does not complete the operation. 2. Deviation counter clear: The chip outputs one-shot signal to clear deviation counter of servomotor drive. 3. Alarm: When receiving alarm signal from servomotor drive, the chip stops outputting pulses[1]
Encoder input (up to 4Xs multiplication possible)	The chip can input encoder signal for present position management. The input signal can be selected from two-pulse signal or 90° phase difference signal (1, 2, or 4 times multiplied)
Origin return using encoder Z-phase signals	The chip stops outputting pulses regarding origin return complete when several encoder Z-phase are counted after origin signal ON. The number of counting encoder Z-phase signals can be changed in a prescribed range
Up/down counter (present position counter)	Up/down counter can be used for present position management, etc. It can count output pulses or signals of encoder, pulser, etc. The input signal can be selected from two-pulse signal or 90° phase difference signal (1, 2, or 4 times multiplied)[3]
Automatic setting of ramping-down point	The number of pulses used for acceleration or calculated number of pulses is automatically written to the ramping-down point setting register[2]
Origin return at up/down counter zero	The chip continues outputting pulses until up/down counter value is zero. The function enables a single command to perform such operation that "Read the present up/down counter value, set the value to the zero direction and start"
Counter latch w/hardware	Input signal latches designated counter value(s). (Input logic can be changed by software technician.)
Comparator	Enables comparison between register value and counter value. When the comparison result satisfies comparison conditions, the level of CMP pin changes. Also, satisfaction of comparison conditions can be used to stop the chip from outputting pulses or to generate interrupt signal. Functions differ depending on modules
External mechanical output	As mechanical position detection signals, the chip can input the following signals: 1. EL signal: Mechanical end limit signal. The chip immediately stops outputting pulses when the end limit signal in moving direction is turned on, and continues stopping if the end limit signal is turned off. Some modules can be set so that EL signal ON causes deceleration stop. 2. SD signal: Mechanical ramping-down signal. When made valid, the SD signal ON lets the chip decelerate pulse output to the starting pulse rate (FL). When the signal is turned off thereafter, the chip accelerates pulse output. 3. ORG signal: Mechanical origin signal used for origin return. Some models can be set so that ORG signal ON stops pulse output after counting encoder Z-phase signals or ORG signal causes deceleration-stop without using SD signal.
Interrupt signal output	Interrupt signal to CPU. Some models can read the interrupt factor (Number of interrupt factors differs depending on model)
Interrupt factor setting	Enables selection of only necessary interrupt factors (event-based interruption)
Interrupt status	Enables monitoring of the factor initiating output of interrupt signal to CPU
Status	Present operating status and external signal input status can be monitored from CPU. Depending on models, status can be monitored from the status address or via registers.
Prebuffer (preregister) for next operation	Buffer for continuous operation with different patters. Writing operating parameters (preset amount, starting pulse rate, operating pulse rate, acel/decel rates, etc.) to preregisters during operation in progress enables the start command to copy the parameters from preregisters to operating registers and the start the chip outputting pulses according to new parameter. Thus, by preparing preregisters for next operation, continuous operation with different patterns is made possible
Automatic start of next operation	With parameter for the next operation written to preregisters, the chip can automatically be started based on parameters of preregisters upon completion of the present operation, thereby enabling continuous operation with no pulse
Command buffer monitor	Enables monitoring of written command
Selection of output pulse logic	Output pulse logic can be changed
Selection of output pulse mode	Output pulse mode can be selected from common pulse mode (command pulse and direction pulse), two-pulse mode (pulse in plus direction and pulse in minus direction) or 90° phase difference signal mode[4]
Excitation sequence output for 2-phase stepper motor	By connecting the output to a stepping motor drive IC or transistor array, a stepping motor controller/drive system can easily be configured
Monitor signal output terminal	Enables the user to monitor the status of operation, constant speed operation, acceleration/deceleration, etc.
Pulser input	Enables the user to output pulses from the pulse output pin by operating the manual pulser at the mechanism. Input pulser signal is 2-pulse signal (plus and minus pulses) or 90° phase difference signal. 90° phase signal can be multiplied by counting
Pulser synchronized positioning	Positioning is made in synchronization with pulser signal. The chip stops outputting pulses after outputting pulses for the present moving amount. If receiving pulses more than the present amount from the pulser, the chip ignores them
Circular interpolation	Circular interpolation is possible between two desired axes
Continuous interpolation	Use of preregisters enables successive linear or circular interpolation
Linear interpolation	Linear interpolation is possible between desired axes of one or multiple chips[5]

Output pulsewidth control	Output pulsewidth can be controlled to quicken stop timing. When the output pulse rate is lower than the reference value, the pulsewidth is constant. When it is higher than the reference value, the pulsewidth duty is 50%. If positioning is complete at the low starting pulse rate (FL), in-positioning can be quickened by making the width of the last pulse shorter
Overriding target position	Target position (moving amount) can be changed during positioning operation progress. If the newly written parameter designates a position already passed, the chip decelerates and stops pulse output (immediately stops when operating at conteant speed), and then moves in reverse direction. Also, pulse output can be stopped by outputting a preset number of pulses based on exteral signal input timing
1-pulse output	One pulse can be outputted w/one command. Starting with a value one preset can be made w/one command
Idling pulse	Enables acceleration to be started after outputting several pulses at the starting pulse rate (FL). This function enables the user to set the starting pulse rate near upper limit of the self-starting pulse rate of the stepper motor
Simultaneous start/stop	Simultaneous start/stop in multiaxial control with multiple chips can be made by connecting all concerned chips through STA pins
External start/stop	Enables the user to start or stop pulse output using external signal
Out-of-step detection	Made possible by mounting a feedback encoder to the stepper motor
I/O port (general-purpose input/output terminal)	Input or output can be defined by setting. If set for output, the port can be used for excitation ON/OFF and stepping motor drive, count-down signal, etc. With some models the I/O port can output interrupt signal to CPU based on level charge
Operating switch input terminal	Enables the user to directly drive the motor by inputting forward or reverse direction signal
Ring count function	Use of counters and comparators in combination enables repetitive operation in a designated counting range. The function can be utilized for such a purpose as counting a rotating table
Backlash correction	Backlash is corrected every time the moving direction is changed (except when making interpolation)
Programmed soft limit	Limit can be programmed by using two comparator circuits. Entering the programmed limit causes immediate stop of deceleration-stop. Thereafter, operation is possible only in reverse direction
Timer operation	The chip can be used as a timer by allowing it to internally perform positioning operation without outputting any pulse
Synchronization signal output	The chip can output a timing pulse signal at designated intervals
Vibration supression	With a control constant designated in advance, one pulse each is added in reverse and forward directions just before stop. This function enables reduction of vibration at the time of stopping the stepping motor. The setting time can be shortened
Independent operating mode	This mode enables the chip to operate with no CPU connected. Write parameters for up to 32 operating patterns from CPU to EEPROM in advance. Then, the chip can operate with CPU removed. Also, mounting to a board the EEPROM in which parameters for operating patterns are written, enables operation without CPU removed
Compatibility to 5V interface	If the supply voltage is 3.3V, each chip uses tolerant buffer for interface, thereby enabling it to connect to 5V with fewer components

[1] PCD2112 inputs the alarm signal at the reset terminal
[2] With PCL6000 series, automatic setting of ramping down point is possible in a range of (decleration time) ≤ (acceleration x 2)
[3] PCL6000 series is equipped with a counter which is usable as a deviation counter
[4] With PCD4600 series 90° phase difference signal can be outputted using the 2-phase stepper motor excitation sequence output
[5] With PCL6113 linear interpolation is made possible by using two or more units

AD Series 2-Phase Stepper Motors

AD1111

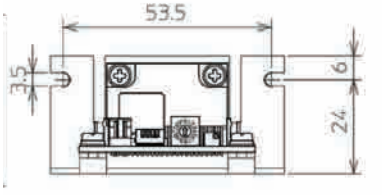
AD1131

AD1231

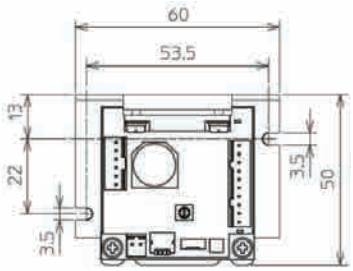
AD1431

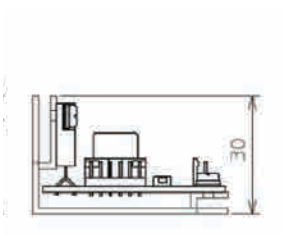
Our AD Series of 2-phase stepper motor drivers are single-axis drivers that come in constant voltage varieties for unipolar motors or constant current chopper drivers for unipolar or bipolar motors.

With advanced features like automatic current reducers and opto-isolated inputs, our AD Series drivers represent the cutting edge of stepper motor electronics.

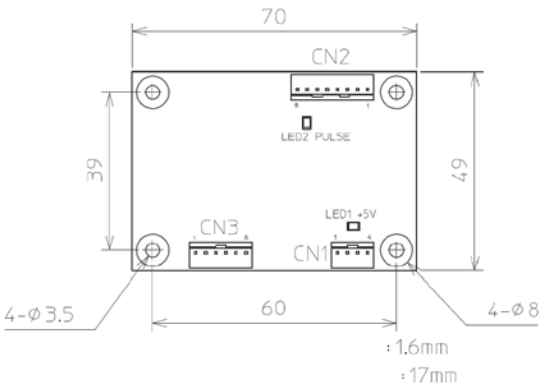


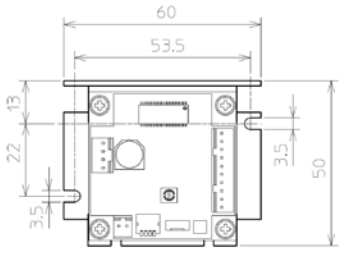
AD1231



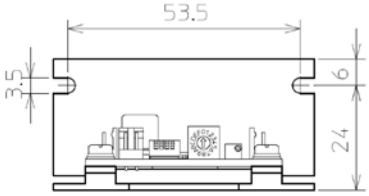


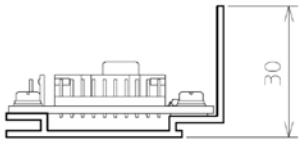
AD1111 and AD1131





AD1431



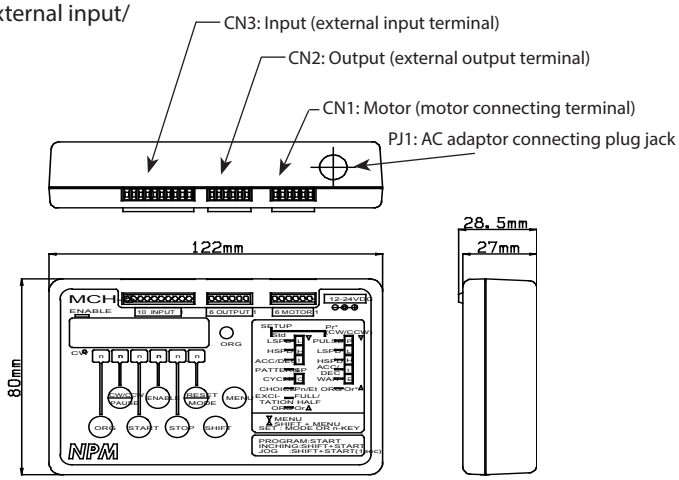


Feature	AD1111	AD1131	AD1231	AD1431
Control Method	Unipolar Constant Voltage	Unipolar Constant Voltage	Unipolar Constant Current	Bipolar Constant Current
Input Voltage	5V DC±5% (Logic) +5V to +30V DC (Motor)	5V DC±5% (Logic) +5V to +30V DC (Motor)	DC12 to 24V±10% Capacity: 3[A], with fuse.	DC12V -10% to DC24V +10% Capacity: 2A, with fuse.
Excitation Method	2 phase (FULL), 1-2 phase (HALF)	2 phase (FULL), 1-2 phase (HALF)	2 phase (FULL), 1-2 phase (HALF), W1-2 phase (1/4), 2W1-2 phase (1/8), 4W1-2 phase (1/16)	2 phase (FULL), 1-2 phase (HALF), W1-2 phase (1/4), 4W1-2 phase (1/16)
Motor Current	DC 5V to 30V 0.35 A per phase	DC 5V to 30V1.1 A per phase	0.13A (MIN) to 2.0A (MAX) / phase Selectable by the rotary switch.	0.11A (MIN) to 1.20A (MAX) / phase Selectable by the rotary switch.
Auto Current Down Control (ACD)	N/A	N/A	Current down operation starts approximately 0.1s after pulse input stops and lowers the output current automatically. Selectable from 25%, 50% or 75% of the current by using switch.	Current down operation starts in approximately 0.1s after pulse input stops and lowers the output current automatically. Selectable from 25%, 50% or 75% of the current by using the switch.
Input Interface	TTL Input Low: 0 -0.5 V High: 1.9V – VCC All input pulse signals must last 10 microseconds or more. After commanding a change in direction, or Full/Half step mode, 10 microseconds must elapse before sending step signals.	TTL Input Low: 0 -0.5 V High: 1.9V – VCC All input pulse signals must last 10 microseconds or more. After commanding a change in direction, or Full/Half step mode, 10 microseconds must elapse before sending step signals.	Pins 1 to 4 of CN2: • Photocoupler (Toshiba TLP112 or equivalent) • Built-in 330 ohm resistor • Forward voltage 1.42V (TYP) • Recommended forward current IF:11mA (Operation forward current IF:10 to 20mA) • Maximum response frequency 160kpps (Input voltage 5V, duty rate 50%) Pins 5 to 8 of CN2: • Photocoupler (Toshiba TLP281 or equivalent) • Built-in 330 ohm resistor • Forward voltage 1.15V (TYP) • Recommended forward current IF:12mA (Operation forward current IF:5 to 50mA)	Pins 1 to 4 of CN2: • Photocoupler (Toshiba TLP109 or equivalent) • Built-in 300 ohm resistor • Forward voltage 1.64V (TYP) • Recommended forward current IF:11mA (Operation forward current IF:10 to 20mA) • Maximum response frequency 160kpps (Input voltage 5V, duty rate 50%) Pins 5 to 8 of CN2 : • Photocoupler (Toshiba TLP281 or equivalent) • Built-in 330 ohm resistor • Forward voltage 1.15V (TYP) • Recommended forward current IF:12mA (Operation forward current IF:5 to 50mA)
Output Interface	N/A	N/A	Pins 9 to 10 of CN2: • Photocoupler (Toshiba TLP281 or equivalent) • Recommended collector current Ic: 10mA (Saturation voltage between collector and emitter : 0.7V)	Pins 9 to 10 of CN2: • Photocoupler (Toshiba TLP281 or equivalent) • Recommended collector current Ic: 10mA (Saturation voltage between collector and emitter : 0.7V)
CW/CCW Command Pulse	One of the following methods can be selected by SW1: 1. Two pulse method (CW/CCW) 2. One pulse method (CLK/DIR)	One of the following methods can be selected by SW1: 1. Two pulse method (CW/CCW) 2. One pulse method (CLK/DIR)	One of the following methods can be selected by the switch: 1. Two pulse method (CW/CCW) 2. One pulse method (CLK/DIR) Photocoupler ON: CCW Photocoupler OFF : CW	One of the following methods can be selected by the switch: 1. Two pulse method (CW/CCW) 2. One pulse method (CLK/DIR) Photocoupler ON: CCW Photocoupler OFF : CW
MOT/OFF Signals	Set with SW3: Logic High = Motor Energized Logic Low = Motor Off	Set with SW3: Logic High = Motor Energized Logic Low = Motor Off	Motor excitation signal Photocoupler ON : Excitation OFF Photocoupler OFF : Excitation ON	Motor excitation signal Photocoupler ON : Excitation OFF Photocoupler OFF : Excitation ON
ACD/OFF Signals	N/A	N/A	Auto current down signal Photocoupler ON : ACD_OFF Photocoupler OFF : ACD_ON	Auto current down signal Photocoupler ON : ACD_OFF Photocoupler OFF : ACD_ON
EORG Output Signals	N/A	N/A	Display signal of 2 phase excitation condition: Photocoupler ON : 2 phase excitation Photocoupler OFF: other than 2 phase excitation	Display signal of initial excitation condition: Photocoupler ON : Initial excitation Photocoupler OFF: other than initial excitation
Operating Temp.	0 to +50°C	0 to +50°C	0 to +50°C	0 to +50°C
Operating Humidity	0 to 80%RH (No condensation)	0 to 80%RH (No condensation)	0 to 80%RH (No condensation)	0 to 80%RH (No condensation)
Storage Temp.	-10 to +60°C	-10 to +60°C	-10 to +60°C	-10 to +60°C
Weight	20 g	20 g	43g (including heatsink)	35g (including heatsink)
Cooling System	Natural cooling	Natural cooling	Natural cooling	Natural cooling

MotionChecker 5

Features

- Equipped with memory feature to retain program settings
- Program operation (repetitive operation of six steps/pattern including zero return) enabled
- Inching operation (one-step operation) enabled
- Jog operation (continuous operation only while operating switch) enabled
- Easy-to-use, compact, and lightweight mobile type with built-in 2-phase stepper motor driving circuit
- Enabled settings include rotation direction, speed control, position control, operation mode, and stop time of stepper motor
- Connecting other external driving circuits enabled by pulse output signals
- Connecting and integrating external device enabled with external input/ output signals
- All-in-one type for easy operation checking



Specification	MCH-5U	MCH-5B
Power Input[1]	12VDC (2A) to 24VDC (1A), 24 watt maximum power supply by AC adaptor	
Protective Fuse	2A fuse mounted on motor power line	
Output Current	250mA/phase (400mA maximum)	400mA/phase (700mA maximum)
Driving System	Unipolar constant voltage	Bipolar constant voltage
Excitation Mode	Full step (2-2 phase), Half step (1-2 phase)	
Operating Temperature	0˚C ~ 40 ˚C	
Operating Humidity	0% ~ 80% RH (no condensation)	
Storage Temperature	-10˚C ~ +70˚C	
External Dimensions	122mm x 80mm x 27mm	
Weight	140g or less	
Environmental Quality	RoHS compliant parts used	
Cooling Method	Air cooling without blowing	
Motor AC Adaptor	Input: 100V ~ 240VAC, Output: 12VDC (2A)	
Motor Part Number	PFCU25-24C1G (1/20)	PFCU20-40S4GA2 (1/10)
Motor Step Angle	0.75˚/step (at 2-2 phase excitation)	0.90˚/step (2-2 phase excitation)
Coil Resistance	120ohms ±7%	160ohms ±7%
Rated Voltage	Terminal voltage: 12.5V (rated 12.5V)	Terminal voltage: 11.0V (rated 12V)
Other	Motor leads (L=250mm), screwdriver, instruction manual	

[1] MotionChecker 5 supports up to 24VDC. However, the attached AC adaptor and motor are 12VDC power input specification.
If you use this unit at a higher voltage, prepare an appropriate AC adaptor and motor.

PPCI-7443 Control Board

Features

- Equipped with PCL6045BL controller chip
- Can control servo or stepper motors
- PCI bus 4-axis motion control
- 32-bit PCI bus plug-and-play capability
- Maximum output frequency of 6.55 Mpps
- Trapezoidal and S-curve motion profile capability
- Can change speed and position "on the fly"
- Capable of circular and linear interpolation
- Simultaneous start-stop on multiple axes
- 28-bit up/down counter for incremental encoder feedback
- Software allows for easy setup, and supports maximum of 12 PPCI7443 cards, allowing operation of up to 48 axes

For more information about this board or the PCL6000 chip series, see page 8.

NPMC6045A-4104 Control Board

Features

- Equipped with PCL6045BL controller chip
- Can control servo or stepper motors
- PC/104 4-axis motion control card
- Maximum output frequency of 6.55 Mpps
- Trapezoidal and S-curve motion profile capability
- Capable of circular and linear interpolation
- 28-bit up/down counter for incremental encoder feedback
- Can change speed and position "on the fly"
- Various homing sequences
- Software allows for easy setup, and includes programming library
- Four isolated multipurpose inputs
- Eight multipurpose outputs
- Line-driver and open-connector encoders available

For more information about this board or the PCL6000 chip series, see page 8.

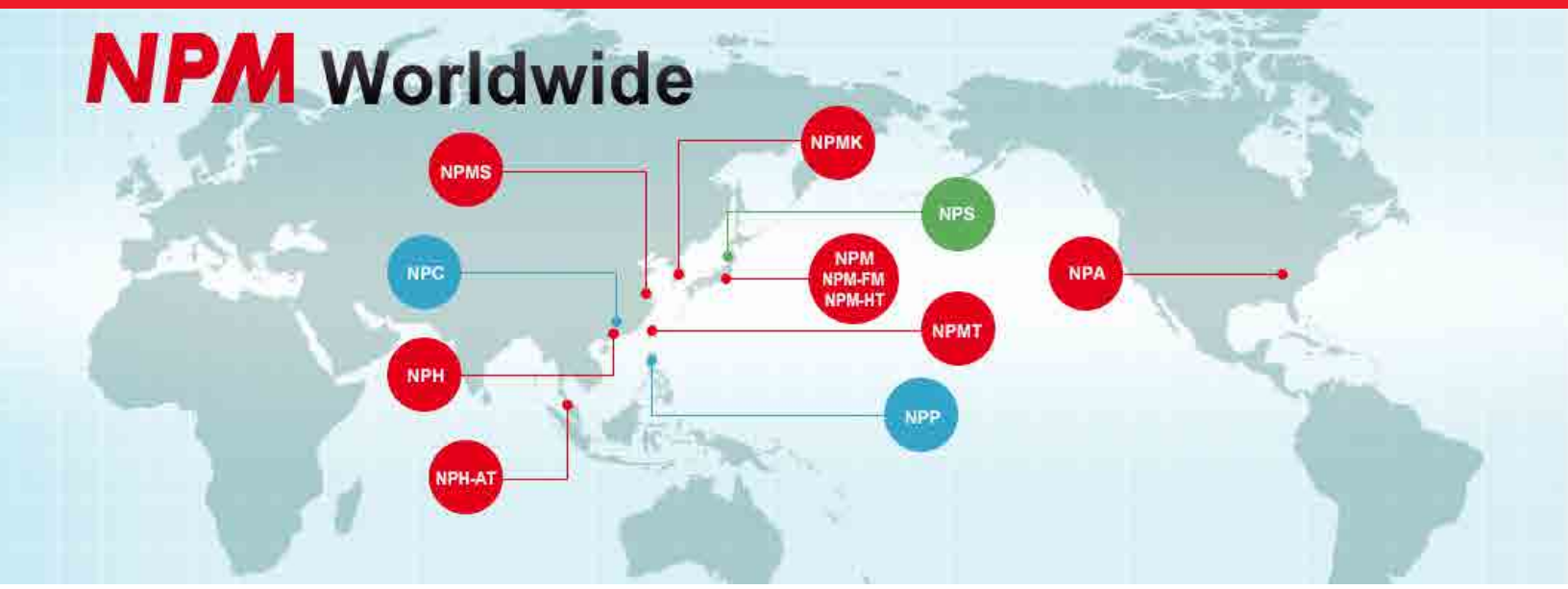
FMC32 Control Board

Features

- Equipped with PCD2112 controller chip for serial bus pulse control
- Contains a 2-phase stepper motor driver to drive a bipolar stepper motor
- Can register up to 32 pattern operations (S-curve and linear), and up to 256 steps of execution sequence program in the internal memory and automatically processes them in the registered sequence without connecting to a PC
- Choose between full step and half step excitation modes
- Operator can write and save operation patterns and execution sequence programs to the nonvolatile memory, using a dedicated USB to 4-wire serial conversion unit (PUSB-3503)

For more information about this board or the PCD2112 chip, see page 10.

NPM Worldwide



Nippon Pulse has subsidiary offices, sales offices, affiliates and production factories in 11 locations.
Nippon Pulse America also has sales representatives and distributors across the United States and Europe.

NPM
Nippon Pulse Motor Co., Ltd.

Head Office
Tokyo, Japan

NPA
Nippon Pulse America, Inc.

Sales Office
Radford, Virginia

NPH
Nippon Pulse Hong Kong, Ltd.

Managing Office
Hong Kong, China

NPMK
Nippon Pulse Korea Co., Ltd.

Sales Office
South Korea

NPMS
Nippon Pulse Shanghai Co., Ltd.

Sales Office
Shanghai, China

NPM-HT
NPM High Technologies Co., Ltd.

Sales Office
Tokyo, Japan

NPMT
Nippon Pulse Motor Trading Taiwan Co. Ltd.

Sales Office
Taiwan

NPH-AT
Nippon Pulse Asia Trading Ltd.

Sales Office
Malaysia

NPS
NPS Co., Ltd.

Affiliate
Akita, Japan

NPC
Pulse Electronics Co. Ltd.

Production
Guangdong Province, China

NPP
Nippon Pulse Tec Philippines Inc.

Production
Philippines

Other Nippon Pulse Products

SLP Stage System

A high-precision stage for industrial applications, the SLP Acculine Series stages offer superior technology that is unmatched in the industry.

As an all-inclusive stage, the SLP stage provides integrated shaft support within the housing and simplifies the transition from conventional ball-screw systems. Because this stage system features a lightweight, compact linear shaft drive, the SLP is a low-profile, high-precision product.

There are no stages on the current market that match the SLP series' force-to-volume ratio, making it an outstanding solution for those with space limitations.

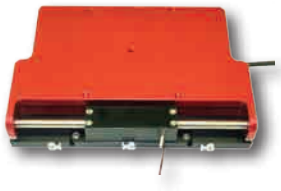
Tin-Can Stepper Motors

The cornerstone of Nippon Pulse, the tin-can rotary stepper is our most recognizable product. A conventional, magnet-driven rotary stepper motor, the tin-can offers a high-performance yet cost-efficient solution. Rotating in proportion to the number of pulses sent to the motor, the tin-can series is frequency synchronized and can change speed depending on the frequency of the pulse signal.

Linear Stepper Motors

A tin-can linear actuator, the PFL/PFCL series (LINEARSTEP®) is designed to provide a simple linear motion system at a fraction of the cost of a conventional rotary stepper motor. Offered in diameters of 25mm and 35mm, the LINEARSTEP® series can also be ordered with one of three pitches on the lead thread screw (0.48mm, 0.96mm, and 1.2mm). This series can be ordered with a choice of windings on a unipolar or bipolar configuration.

SCR Stage System



The SCR Nanopositioning Series offers the accuracy of piezo-driven stages with the speed and performance of servo stages. Through complex motion profiles, the SCR series produces extremely accurate results with no loss in stability.

The SCR stage also includes an integrated cross-roller guide. With a simple, lightweight, compact shaft-type linear motor comprised of only a magnet and a coil, large drive force is gained with an efficient and short coil length, allowing for high speed and high precision applications.

Linear Shaft Motor

Nippon Pulse's Linear Shaft Motor (LSM) is a brushless, high-precision direct-drive linear servomotor in a tubular design. Consisting of a magnetic shaft and moving coil assembly (forcer), the linear shaft motor is driven and controlled by the flow of current. The basic design of this motor has three major concepts. The design is simple (only two parts and a non-critical air gap), non-contact (no sound or dust; maintenance free), and high precision (no iron, no cogging). This product is offered with 11 unique shaft diameters, from 4mm to 50mm, and can span lengths ranging from 20mm to 4.6M.

Linear Hybrid Stepper Motors

Linear Hybrid Steppers (PJPL series) function in a wide variety of applications and include an integral lead screw or ball screw for converting rotary motion into linear motion. Nippon Pulse's hybrid linear stepper motors are suitable for medical devices, microtiter tables, fluid dispensers, semiconductor wafer handling machines, optical systems, and data storage machines.

NPM Nippon Pulse

Your Partner in Motion Control

nipponpulse.com … info@nipponpulse.com

phone: 1-540-633-1677 … fax: 1-540-633-1674

The Nippon Pulse Advantage

For more than 60 years, Nippon Pulse has built state-of-of-the-art products based on a solid foundation of advancing technology and thorough product research.

Nippon Pulse faithfully provides these high-quality products to a wide range of industries in North and South America and Europe. We have established ourselves as a leader in stepper motor, driver and controller technology while introducing innovative products, such as the Linear Shaft Motor. At Nippon Pulse, we believe that by bringing products to market that meet the customers' requirements and exceed expectations, we contribute to the progression of technology and its positive impact on our society.

We have representatives throughout North and South America and Europe to assist customers directly. Limited quantities of stock on standard motors and electronics are available to allow faster response to customer needs. In addition, Nippon Pulse has a model shop in its North American headquarters for quick turnaround on custom prototypes and special orders. Our mission is to faithfully create the new products sought by our customers and to contribute to the development of society from a global viewpoint.

When you choose a Nippon Pulse motor, driver, controller, network or stage, you're doing more than just buying a quality product: you're benefitting from what we call the Nippon Pulse Advantage. This includes superior prototyping, complete system engineering, proper compliance and certification according to international guidelines, exceptional tailoring to your needs, and unmatched support.

A wholly owned subsidiary of Nippon Pulse Motor Co., Ltd., Nippon Pulse America is headquartered in Radford, Va.

NPM

4 Corporate Drive
Radford, Va. 24141 USA
phone: 1-540-633-1677 … fax: 1-540-633-1674
nipponpulse.com … info@nipponpulse.com

Nippon Pulse Representative Information

bsi. ISO 9001 Quality Management FS 645238 ISO 14001 Environmental Management EMS 645237