※Please note that the specifications are subject to change without notice due to product improvements.

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NPM

super high-speed serial communication system

Motionnet®

Remote I/O & Remote Motion

Serial communication for motors, I/Os and data

Center device G9001A
I/O device G9002
PCL (motor control) device G9003
CPU emulation device G9004

NPM Nippon Pulse Motor Co., Ltd.

Reduce wiring for all motors, I/O points, and data lines

Motionnet®

Remotel/O & RemoteMotion

1. Maximum of 64 axes and 2048 I/O points

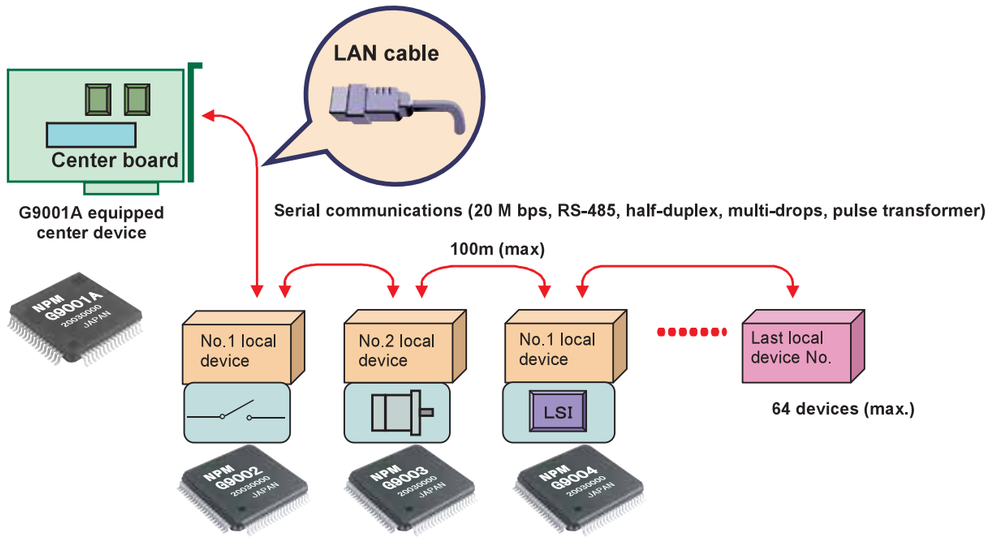
Combinations can be changed.

2. High speed communication time 15.1 μsec/local device

While in cyclic communication.

3. Available as a board or a chip

Proprietary communication LSI.



4 device types, to match any application: Local devices ICs (G9002, G9003, G9004)

Motionnet® is a super high-speed serial communication system developed by NPM.
Four G9000 series devices were developed by NPM which allow creating Motionnet that greatly reduces wiring requirements. The G9000 devices with their high-speed serial communications (up to 20 Mbps) can be used for input/output control, motor control, CPU emulation and message communication, remotely, all of which are required by current Factory Automation techniques.
Motionnet always transfers 4 bytes of data in 15.1 μsec. using cyclic communication to control input and output. It can communicate a maximum of 256 bytes of data in this transfer mode, such as motor control data, and LSI control data using interrupts.
Communication times can be calculated using formulas, allowing you to see that Motionnet guarantees the real-time oriented support needed by FA industries.
We confidently recommend our Motionnet as the best major communication system solution for jobs like controlling FA equipment.

Product Features — Motionnet®

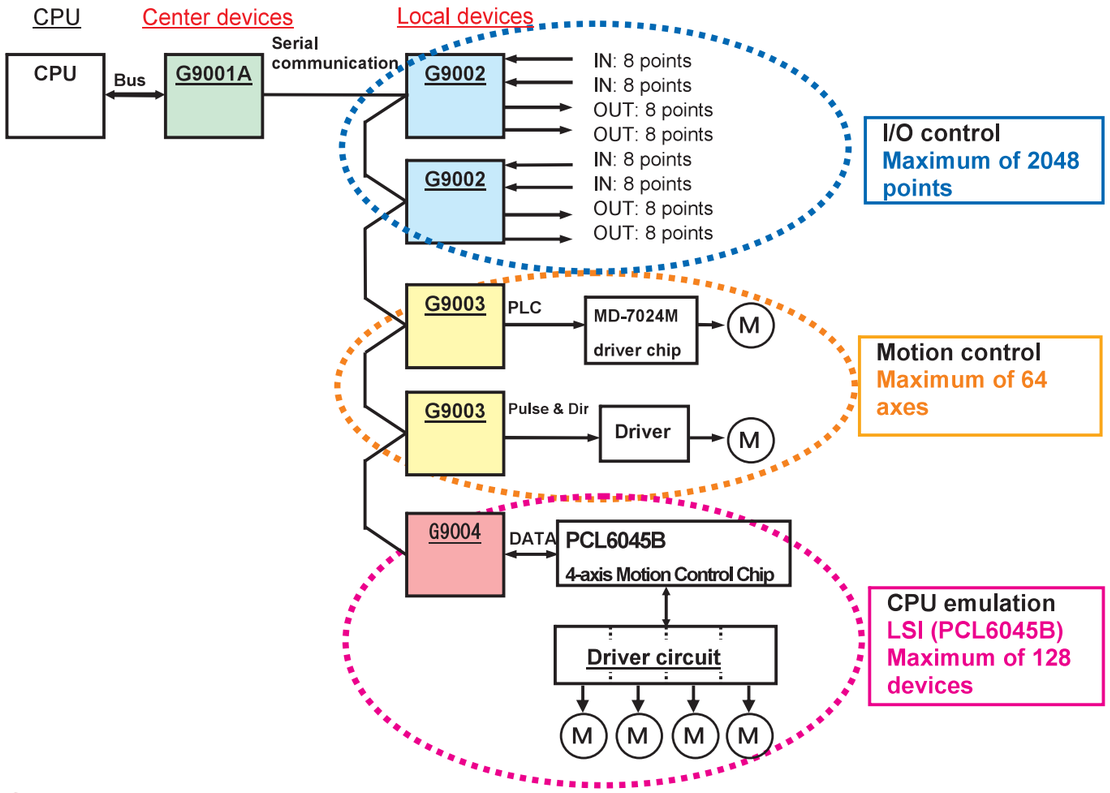
1) Transfer speed up to 20 Mbps
2) Maximum 64 local boards for each serial line on a center board.
   Input/output control of up to 256 ports (2048 points), motion control of up to 64 axes, and LSI control of up to 128 devices.
3) Input/output and status communication time for each device
   When inputting/outputting and reading status data for each device, the system automatically refreshes the center device RAM each communication cycle.
   (Cyclic communication: 15.1 μsec./local device)
   When 32 local devices are connected (1024 points of input/output): 0.49 msec.
   When 64 local devices are connected (2048 points of input/output): 0.97 msec.
4) Data communication time
   Cyclic communication can be interrupted with a command from the CPU.
   Data communication time: 19.3 μsec. to send or receive 3 bytes (e.g. when writing feed amount data to the G9003).
   Data communication time: 169.3 μsec. to send or receive 256 bytes.
5) Serial communication connection cable
   Multi-drop connections using LAN cables or dedicated cables.
   Total cable length of one line: 100 m (20 Mbps/32 local boards) (10 Mbps/64 local boards).
   Cable length between local boards: 0.6 m or longer.
6) Compatible control language and programs
   DLL (VisualBasic, VisualC++) for controlling each local board, and EzLINK (utility program).

Ultra-High-Speed Serial Communication Devices: G9000 Series — Motionnet®

Device		Outline of the functions
Center	**Center device G9001A**	- Center device for the Motionnet serial communication system. - An proprietary device used to control serial communication when connected to a CPU. - Contains 256 bytes of RAM for each input/output point, or device status information, and 512 bytes RAM used for data communication. - The RAM for each input/output point, or device status information, stores input/output data, local device information, and I/O port change interrupt functions. It refreshes the information by sending and receiving data to local devices at fixed intervals (determined by the number of devices connected) using cyclic communication. - The RAM used for data communication works on the FIFO method. After the data to send is written to the FIFO buffer, the device will send the data to the local devices when a send command is written. As data is received, it is stored in the FIFO buffer. The center device sends and receives data by interrupting ongoing cyclic communication when triggered by a data write send command from the CPU.
Local	**I/O device G9002**	- A local device used by the center device to control the input/output signals for 4 ports (1 port = 8 points). - The device always handles I/O signal control with the center device using cyclic communication.
	PCL device G9003	- A local device used to control a single axis servomotor or stepper motor according to commands from the center device. - This device always exchanges status information regarding general input/output signals and axis control with the center device using cyclic communication. The data communication method is used to read axis control commands and register information.
	CPU emulation device G9004	- A local device used to create CPU terminal signals (control signal, addresses, data bus signals) according to commands from the center device - Remote control from the center device is possible by connecting various high-function devices to the CPU terminal signals. - This device always exchanges device status information (interrupt and FIFO status) with the center device using cyclic communication. It sends CPU terminal information using the data communication method.

Connection Configuration Diagram

Motionnet®

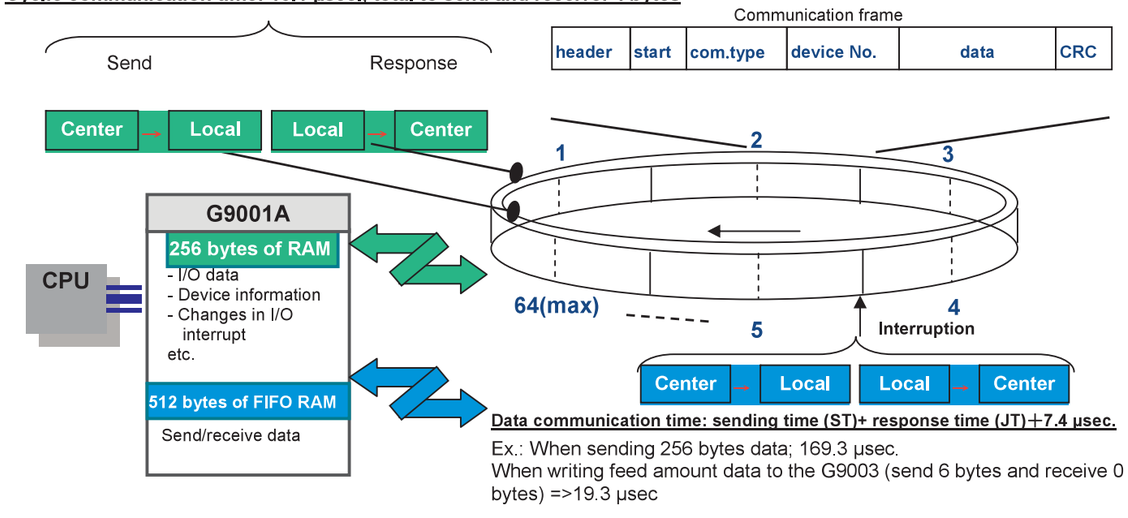


Communication type and Communication Time

Motionnet®

- **Communication type**
  1) System communication: Check local device connection status.
  2) Cyclic communication: Control input/output, status information. Always renew data.
  3) Data communication: Write a command and register data by interrupting cyclic communication.
- **Communication time**

Cyclic communication time: 15.1 µsec., total to send and receive: 4 bytes



Data communication time: sending time (ST)+ response time (JT)+7.4 µsec.

Ex.: When sending 256 bytes data; 169.3 µsec.
When writing feed amount data to the G9003 (send 6 bytes and receive 0 bytes) =>19.3 µsec

Center Devices

Motionnet®

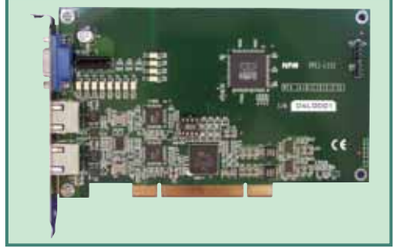
Center device	**Motionnet®** center device External dimensions: 10 mm x 10 mm Number of terminals: 64 pins CPU I/F: Z80, 8086, 68000, H8
	- It can control a maximum of 64 local devices with commands from a CPU.

Center board (PCI) [G9001A x2]

■ Specifications

Bus	PCI
Motionnet communication line	2 lines
Communication speed	2.5 M, 5 M, 10 M, 20 Mbps
Communication interface	RS-485 (using a pulse transformer)
Communication system	Half-duplex
Communication distance	100 m, maximum
Parallel I/O	8 input points/4 output points

PPCI-L112



Center board (PC/104) [G9001A x2]

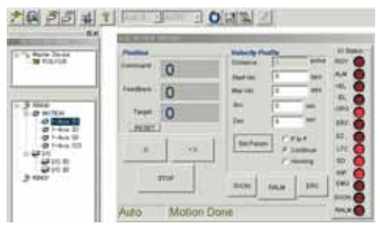
■ Specifications

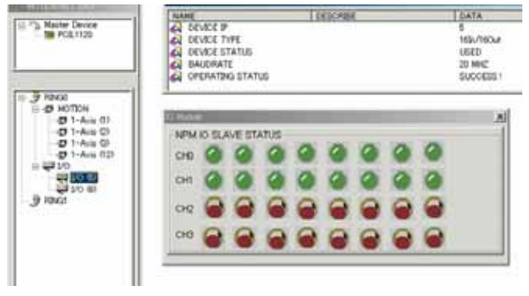
Bus	PC/104 (16 bits)
Motionnet communication line	2 lines
Communication speed	2.5 M, 5 M, 10 M, 20 Mbps
Communication interface	RS-485 (using a pulse transformer)
Communication system	Half-duplex
Communication distance	100 m, maximum
Parallel I/O	8 input points/8 output points

NPMCMNET-I/O104

Common accessory programs

- **Device drivers for Windows2000, and XP**
- **DLL:** A libraries for operating the Motionnet system.
  - A dynamic link library (Low Level DLL routines) is also available that allows direct access to a device by assigning an address.
  DLL, sample programs VisualBasic, VisualC++
- **EzLink** (utility program) **[PCI board]**
  - Easily check the operation and collection lines of the Motionnet.
- **Sample programs for MS-DOS (C-language, source code) [PC/104 board]**





Center unit (USB) [H8CPU + G9001A]

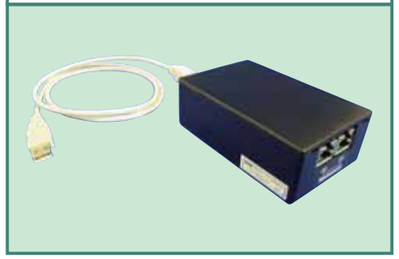
Features

Connect to a host PC using the USB port (ver1.1), the unit can be used as start-up in the initial construction, and for evaluation, as well as line monitor (when debugging).
Compact size [W100 x D65 x H35 mm]

■ Specifications

USB	Ver1.1 (max. speed: 12 Mbps)
Number of Motionnet communication line	1 line
Communication speed	2.5 M, 5 M, 10 M, 20 Mbps
Communication interface	RS-485 (Using a pulse transformer)
Communication system	Half-duplex
Communication distance	100 m, maximum

MNET-PUSB3601



Application programs

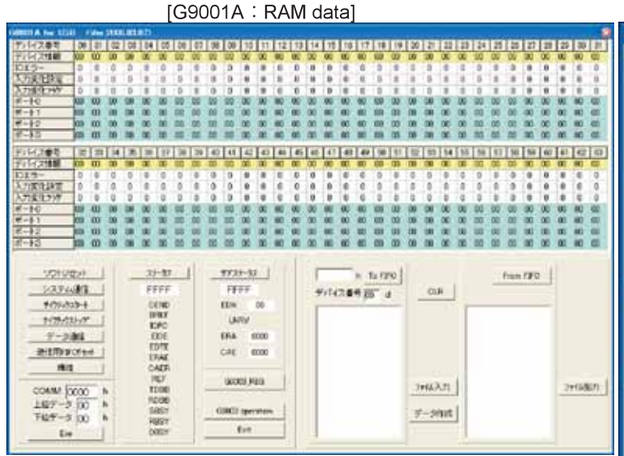
Function 1: Line monitor function (support tool to construct a system)

- Check packet type and data status on a serial circuit using a dedicated program tool.
- Can be inserted at any point in a Motionnet serial line.
- Stores approx. 4,000 packets (or more) in the internal memory.

Function 2: USB center unit function (to practice operation methods and make system adjustments)

- Visually check the RAM area of the G9001A.
- A dedicated function for controlling the G9003/9004.
- Support tool used to create CPU emulation commands.

[G9001A：RAM data]



[Line monitor: Packet data]

[Line monitor: Insert at any point in the system]

Center module (FA-M3) [G9001Ax2]

This was jointly developed with Yokogawa Electric

Features

Proprietary to the FA-M3R, made by Yokogawa Electric.
Connects directly to the PLC bus.
Connect to a PC through the USB port.

Under development

The IT M@Chine Controller FA-M3R

MNETF3-C2

e-RT3 eMbedded M@chine Controller

VxWorks iTRON

OS-9 WindowsCE

■ Specifications

Item	MNETF3-C2
Transfer speed	20 Mbps, 10 Mbps, 5 Mbps, 2.5 Mbps
Total cable length	100 m (10 Mbps, 64 devices)
Number of devices that can be connected	128 units (64 units/line)
Max. nbr. of I/O points	4096 points (2048 points/line)
Max. nbr. of motors that can be controlled	128 axes (64 axes/line)
Communication method	Half-duplex communication (2-line system)
Coding method	Signed NRZ method
Communication protocol	Motionnet original
Error control method	CRC, 12 bits
Communication type	System communication Cyclic communication Data communication
Connection method	Multi-drop method
Communication interface	RS-485 (using pulse transformers)
Connection cable	LAN cable, CAT5 or better (UTP or STP)
Termination resistance	Integrated
Connector	RJ45
Connection to a PC	USB (Ver1.1)
Current consumption	400 mA or less
External dimensions	28.9(W) x 100(H) x 83.2(D) mm
Weight	120 g

I/O device	**Motionnet®** local device External dimensions: 12 mm x 12 mm Number of terminals: 80 pins
	- Controls input and output signals for 4 ports (1 port = 8 bits).

Local input/output board, 32 points isolated type [G9002]

MNET-D340	MNET-D322	MNET-D304
		
32 input points	**16 input points/16 output points**	**32 output points**

Features

Separate internal power regulation, flat cable connector, DIN rail mounting system, compact size [W124 x D72.5 x H50 mm]

■ Input specifications

8 points / common
Photocoupler input (sink type output)
Input signal voltage: 24 VDC

■ Output specifications

8 points / common
Open collector output (sink type)
Maximum rated voltage: 50 VDC
Recommended operation voltage: 12 to 24 VDC
Maximum output current: 80 mA/point

Local, compact I/O board, 16 points, not isolated

MNET-D420	MNET-D411	MNET-D402
		
16 input points	**8 input points/8 output points**	**16 output points**

Features

Flat cable connector, DIN rail mounting system, and super compact size [W59.5 x D56.5 x H35.7 (22.5) mm]

■ Input specifications

8 points / common
Photocoupler input (sink type output)
Input signal voltage: 24 VDC

■ Output specifications

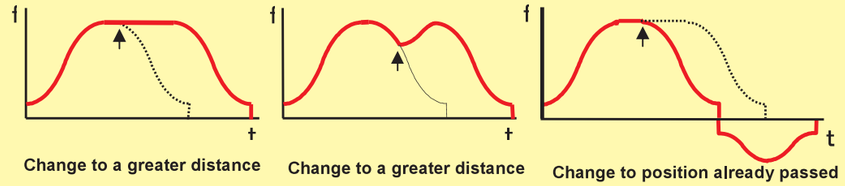
8 points / common
Open collector output (sink type)
Maximum rated voltage: 40 VDC
Recommended operation voltage: 24 VDC
Maximum output current: 100 mA/point

PCL device	**Motionnet®** local device External dimensions: 12 mm x 12mm Number of terminals: 80 pins
	- Controls a single axis servomotor or stepper motor (pulse train output). - Has a 2-phase stepper motor excitation sequence function.

■ Common specifications for the motor control section

Max. output frequency	6.5 Mpps
Mechanical position counters	28 bits x 2 and 16 bits x 1 (deflection counter)
Comparators	28 bits x 3
Acceleration/deceleration characteristics	Linear and S-curve (acceleration and deceleration can be specified separately), triangle drive suppression function.
Positioning range	28 bits (±134,217,727 pulses)
Speed override	Speed can be changed during operation

The target position can be changed while operating.



Change to a greater distance | Change to a greater distance | Change to position already passed

Local single-axis motion control board [G9003]

Features

Pulse train output (general-purpose type)
A variety of input/output functions
Cables for connecting to motor drivers are available as options.
DIN rail mounting system.
Compact size [W124 x D72.5 x H50 mm]

MNET-M101-DUM

▶ Input

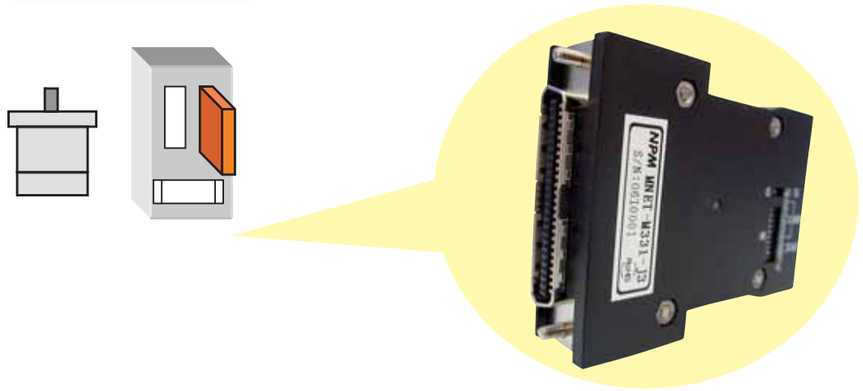
ORG, SD, ±EL, EMG, encoder A/B/Z phases, ALM, INP, SVRDY
Simultaneous start/stop, start positioning, latch counter, clear counter, general-purpose input, 24 VDC

▶ Output

Clear deflection counter, SVON, ALMRES, BSY, comparator

Local single-axis motion control board [G9003]

MOTION connector



For MINAS A/AⅢ/A4 AC servo driver made by Matsushita Electric Co., Ltd.	MNET-M321-MIA
For MR-J3 AC servo driver made by Mitsubishi Electric Co., Ltd.	MNET-M331-J3
For SⅡⅢAC servo driver made by Yasukawa Electric Co., Ltd.	MNET-M341-S23
For Q AC servo driver made by Sanyo Electric Co., Ltd.	MNET-M351-SAN
For VPS AC servo driver made by Nikki Denso Co., Ltd.	MNET-M361-VPS
For αSTEP AS(C) made by Oriental Motor Co., Ltd.	MNET-M371-AS

Features

Can be inserted directly into I/O connectors for the above drivers.
No need to wire the connections to the drivers above.

▶ Driver inputs/outputs

Pulse commands, encoder A/B/Z phases, ALM, INP, SVRDY
SVON, ALMRES, clear deflection counter, 24 VDC

▶ Mechanical input/output

ORG, SD or comparator, ±EL, EMG

When connected to the MR-J3

Local 2-phase stepper motor driver [G9003]

Features

A driver integrated controller.
1/256 micro step.
Allows direct motor control using serial communication, since the driver and control sections are integrated in one unit.
Compact size [W124 x D72.5 x H50 mm].

MNET-BCD4020FB

▶ Input

ORG, SD, ±EL, EMG, encoder A/B/Z phases
Simultaneous start/stop, latch counter, general-purpose input

▶ Output

Comparator, general-purpose output

■ Driver specifications

Driven system	2-phase, bi-polar rated current driving system
Current setting	Selectable from 5 current levels using a switch (0.5 to 2 A/phase)
Current reduction	Selected by a switch, auto or general-purpose output
Excitation ON/OFF	Controlled using a general-purpose output from the G9003
Micro steps	1/2 to 1/256, selected using a switch
Power required	24 VDC

Local 2-phase stepper motor driver [G9003]

Features

Ultra small, a driver integrated controller.
Allows direct motor control using serial communication, since the driver and control sections are integrated in one unit.
Smaller than a business card [W75 x D50 x H28 mm]

MNET-BCD4020FU

▶ Input

ORG, SD, ±EL, EMG

■ Driver specifications

Driving system	2-phase, unipolar rated current driving system
Current setting	Selected using a variable resistor (0.2 to 2 A/phase)
Current reduction	Selected by a switch, auto or general-purpose outputs
Excitation ON/OFF	Controlled by a general-purpose output from the G9003
Micro steps	1/2 to 1/16, selected using a switch
Power required	24 VDC

PCL emulation device	**Motionnet**® local device External dimensions: 12 mm x 12mm Number of terminals: 80 pins
	- Remote control when connected to a high-performance device. - Up to 256 axes can be controlled when connected to two NPM PCL6143 high-function pulse control LSIs.

Pulse control LSI
PCL6143

■ Specifications common to the motor control section	
Number of axes	4 axes (linear interpolation)
Machine position counters	28 bits x 2 per axis
Comparators	28 bits x 2 per axis
Acceleration/deceleration characteristics	Linear and S-curve (independent setting of acceleration and deceleration is possible), triangle drive suppression function
Positioning range	28 bits (±134,217,727 pulses)
Pre-register	Continuous positioning function
Speed override	Can change speed during operation
Position override	Can change the target position during operation

■ Local 4-axis 5-phase stepper motor driver [G9004 + PCL6143]

■ Driver specifications

Driving system	5-phase bipolar rated current driving system New pentagonal wiring (5 or 10 lead wires)
Current setting	Selected using a switch (0.75 A/1.4 A) Can be set to any value using a variable resistor
Automatic current reduction	Enable/disable (Controlled using PCL6143 general-purpose output) Can be set to any value using a variable resistor
Excitation ON/OFF	Control using a PCL6143 general-purpose output
Step	Switch between full and half, using a switch
Power required	24 VDC (maximum 4.5 A 1.4 A/phase when driving 4 axes)
Dimensions	[W175 x D145 x H29 mm]

MNET-BCDC5030A4

■ Local 4-axis 2-phase stepper motor driver [G9004 + PCL6143]

■ Driver specifications

Driving system	2-phase unipolar rated current driving system
Current setting	Using a variable resistor (max. 2 A/phase)
Automatic current reduction	Enable/disable (controlled by a PCL6143 general-purpose output)
Excitation ON/OFF	Control using a PCL6143 general-purpose output
Micro steps	1/1 to 1/16, selected using a switch
Power required	24 VDC (maximum 4.2A, 2A/phase when driving 4 axes)
Dimensions	[W145 x D130 x H30 mm]

MNET-BCD4020FUA4

▶ Inputs/outputs common to 4-axis drivers

ORG, SD or start positioning, ±EL, EMG
Encoder A/B phases*1, manual pulsar*1, counter latch*1, general-purpose input/output*1, simultaneous start/stop, simultaneous ramp down

(*1: An external interface circuit is needed.)

CPU emulation device	**Motionnet**® local device External dimensions: 12 mm x 12 mm Number of terminals: 80 pins
	- Remote control when connected to a high-performance device. - Maximum of 256 axes can be controlled when connected to 2 NPM PCL6045B high-function pulse control LSIs.

Pulse control LSI
PCL6045B

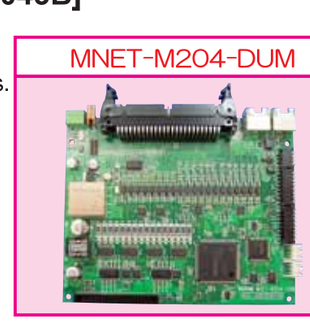
■ Specifications common to the motor control section	
Maximum output frequency	6.5 Mpps
Number of axes	4 axes (linear interpolation, arc interpolation of any two axes)
Machine position counters	28 bits x 3 per axis and 16 bits x 1 per axis (deflection counter)
Comparators	28 bits x 5 per axis
Acceleration/deceleration characteristics	Linear and S-curve (set acceleration and deceleration independently), triangle drive suppression function
Positioning range	28 bits (±134,217,727 pulses)
Pre-register	Continuous positioning function
Speed override	Can change speed during operation
Position override	Can change the target position during operation

■ Local 4-axis motion control board [G9004 + PCL6045B]

Features

Pulse train output (general-purpose type)
Cables for connecting to each motor driver are available as options.
NPM PC/104 4-axis control board
Pin assignment identical to the NPMC6045A-4104
Dimensions [W148 x D120mm]

MNET-M2O4-DUM



▶ Input

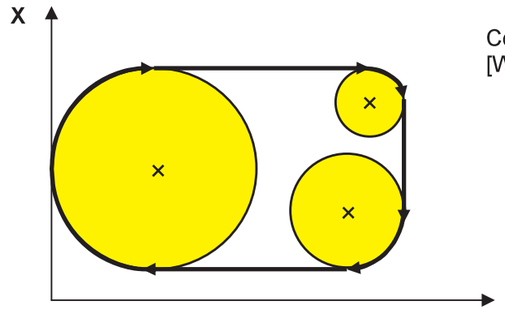
ORG, SD or start positioning, ±EL, EMG, encoder A/B/Z, ALM, INP, SVRDY, simultaneous start and stop
24 VDC, manual pulsar*1, counter latch*1, general-purpose I/O, and counter reset*1

(*1: An external interface circuit is needed.)

▶ Output

Clear deflection counter, SVON, ALMRES

◆ **Operation example**



Arc, linear continuous operation using the pre-register function

◆ **Custom case (optional)**

Compact unit
[W28 x D125 x H180 mm]

Serial communication connection cable

For the **Motionnet®**, use LAN cables (100BASE, 1000BASE) that are guaranteed for use in high speed communication or a pair of thin proprietary cables (made by NPM).

Commercially available LAN cable (4 pair)

Features: Cheap and easy to obtain. A variety of types (length)
UTP/STP cable that conforms to any of the following.
Wiring standard: - TIA/EIA-568-B
- Category 5 (CAT5)
- Enhanced category 5 (CAT5e)
- Category 6 (CAT6)

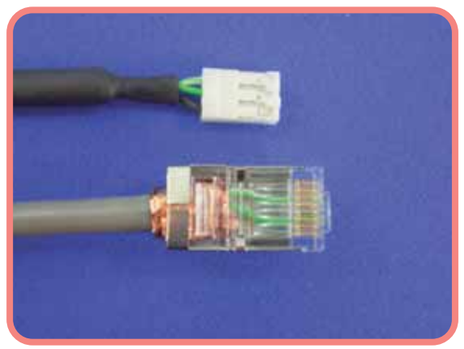
NPM custom cable (1 pair)

Features: Thin and soft, easy to lay out. The following harness cables are available.
Wiring standard: STP cable equivalent to category 5 (CAT5)

CAT5-1STP K-SP-10445 cable	10m	1250-411100

Harness cables

Connector type	Model name	Length	Article No.
CN: RJ45 <=> RJ45	RJ-RJ (0.6) K-SP-10493-001 cable	0.6 m	1250-411000
	RJ-RJ (1) K-SP-10493-002 cable	1 m	1250-411001
	RJ-RJ (2) K-SP-10493-003 cable	2 m	1250-411002
	RJ-RJ (3) K-SP-10493-004 cable	3 m	1250-411003
CN: RJ45 <=> DF1B	RJ-DF (0.6) K-SP-10494-001 cable	0.6 m	1250-411004
	RJ-DF (1) K-SP-10494-002 cable	1 m	1250-411005
	RJ-DF (2) K-SP-10494-003 cable	2 m	1250-411006
	RJ-DF (3) K-SP-10494-004 cable	3 m	1250-411007
CN: DF1B <=> DF1B	DF-DF (0.6) K-SP-10495-001 cable	0.6 m	1250-411008
	DF-DF (1) K-SP-10495-002 cable	1 m	1250-411009
	DF-DF (2) K-SP-10495-003 cable	2 m	1250-411010
	DF-DF (3) K-SP-10495-004 cable	3 m	1250-411011



Bus specifications	Product name	Model name	Article No.	Page
PCI bus	Center board (PCI)	PPCI-L112	1250-213000	4
PC/104 bus	Center board (PC/104)	NPMCMNET-I/O104	1250-212500	4
USB	Center unit (USB)	MNET-PUSB3601	1250-213600	5
PLC Yokogawa Electric	Center module (FA-M3)	MNETF3-C2	-	6
Local input board (IN32)		MNET-D340	1250-212600	7
Local input/output board (IN16/OUT16)		MNET-D322	1250-212700	7
Local input board (OUT32)		MNET-D304	1250-212800	7
Local compact input board (IN16)		MNET-D420	1250-213200	7
Local compact input/output board (IN8/OUT8)		MNET-D411	1250-213500	7
Local compact output board (OUT16)		MNET-D402	1250-213300	7
Local single axis motion control board, general purpose		MNET-M101-DUM	1250-212900	8
Local 4-axis motion control board, general purpose		MNET-M204-DUM	1250-213900	12
Local single axis motion control board, Matsushita MINAS		MNET-M321-MIA	1250-213800	9
Local single axis motion control board, Mitsubishi MRJ3		MNET-M331-J3	1250-213400	9
Local single axis motion control board, Yasukawa Σ Ⅱ Ⅲ		MNET-M341-S23	1250-213700	9
Local single axis motion control board, Sanyo Q		MNET-M351-SAN	1250-214100	9
Local single axis motion control board, Nikki Denso VPS		MNET-M361-VPS	1250-214200	9
Local single axis motion control board, Oriental Motor αSTEP		MNET-M371-AS C	1250-214300	9
Local 2-phase stepper motor driver (bipolar)		MNET-BCD4020FB	1210-700200	10
Local 2-phase stepper motor driver (unipolar)		MNET-BCD4020FU	1210-700500	10
Local 4-axis 5-phase stepper motor driver		MNET-BCDC5030A4	1210-800300	11
Local 4-axis 2-phase stepper motor driver (unipolar)		MNET-BCD4020FUA4	1210-700400	11
Serial communication cable			-	13