Motionnet 5-phase Stepper Drive

STP-M510A
STP-M511A
STP-M512A

User Manual

Version: V1.0 2024Sep09

To properly use the product, read this manual thoroughly is necessary.

Part No.: 81-00STP50-010

Revision History

Date	Revision	Description
2024/09/09	1.0	Document creation.

Electrical safely

- To prevent electrical shock hazard, disconnect the power cable from the electrical outlet before relocating the system.
- When adding or removing devices to or from the system, ensure that the power cables for the devices are unplugged before the signal cables are connected. Disconnect all power cables from the existing system before you add a device.
- Before connecting or removing signal cables from motherboard, ensure that all power cables are unplugged.
- Seek professional assistance before using an adapter or extension card. These devices could interrupt the grounding circuit.
- Make sure that your power supply is set to the voltage available in your area.
- If the power supply is broken, contact a qualified service technician or your retailer.

Operational safely

- Please carefully read all the manuals that came with the package, before installing the new device.
- Before use ensure all cables are correctly connected and the power cables are not damaged. If you detect and damage, contact the dealer immediately.
- To avoid short circuits, keep paper clips, screws, and staples away from connectors, slots, sockets and circuitry.
- Avoid dust, humidity, and temperature extremes. Do not place the product in any area where it may become wet.
- If you encounter technical problems with the product, contact a qualified service technician or the dealer.

Contents

1. Introduction

STP-M5 is a 5-phase high speed Motionnet interfaced stepping motor driver. Encoder support and high precision position drive simplifies the control of motion.

1.1. Precautions

1.1.1. Safety precautions

When you operate a stepper motor, you must take the utmost care to keep people from entering the zone in which components are being moved by the motor. In addition, provide an emergency stop mechanism to stop the motor operation instantly if a person is in danger.

1.1.2. Handling precautions

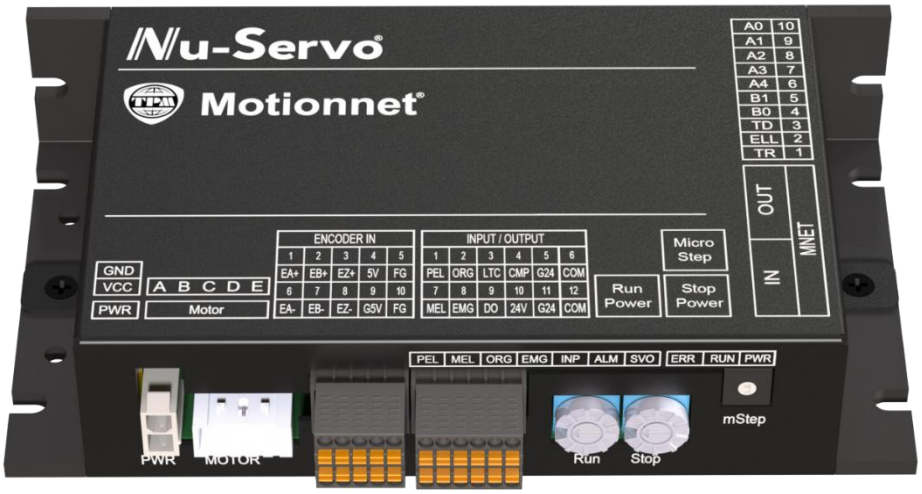
- Inputting power
  Do not connect or disconnect connectors and signal lines while this board or peripheral circuits are supplied with power.

- Static electricity
  This board uses a CMOS device. Therefore, this board must be stored in a package in which it was shipped until you use it, in order to prevent damage from static electricity.

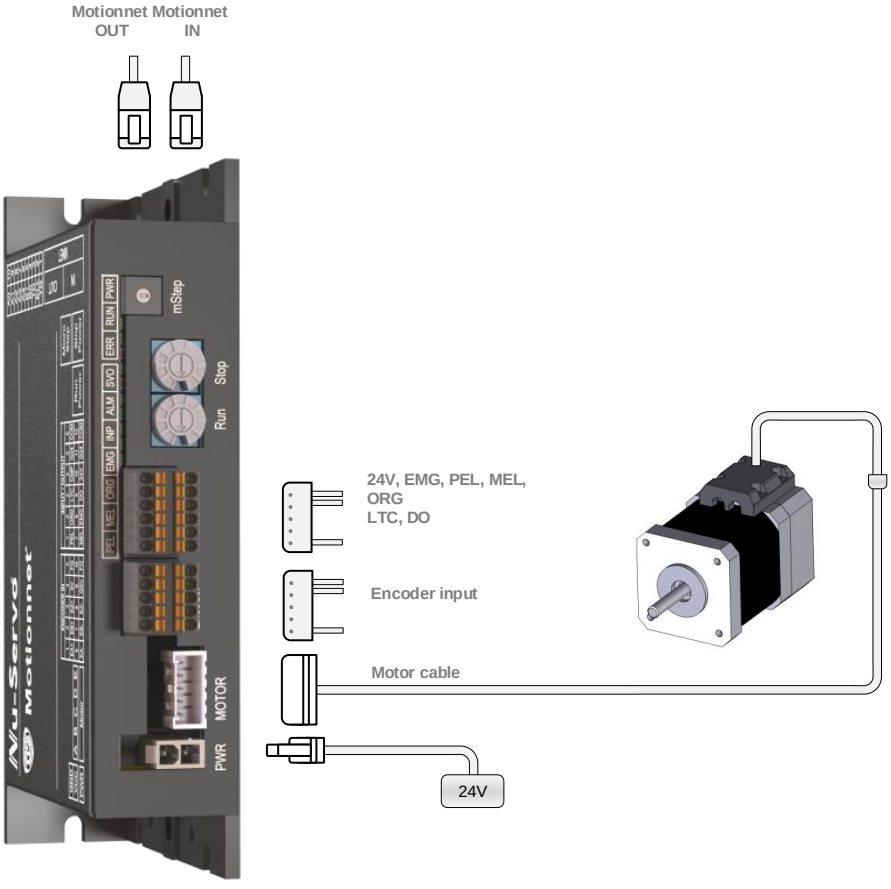
- Switch settings
  This board is equipped with switches to set details for serial communications and input/outputs. Be sure to shut off the power supply to the board before changing these switches.

- Connections to electrically noisy devices
  Interference from excessively noisy devices or from power surges on the power and I/O circuits may cause the board to malfunction. To connect to a device, which may generate electrical noise, we recommend taking countermeasures, such as attaching a protective circuit to the input/output circuits. However, it is best not to share the same power supply with noise generating sources.

1.2. Features



STP-M510A – Motionnet 5-phase 0.75A micro step drive
STP-M511A – Motionnet 5-phase 1.4A micro step drive
STP-M512A – Motionnet 5-phase 2.8A micro step drive

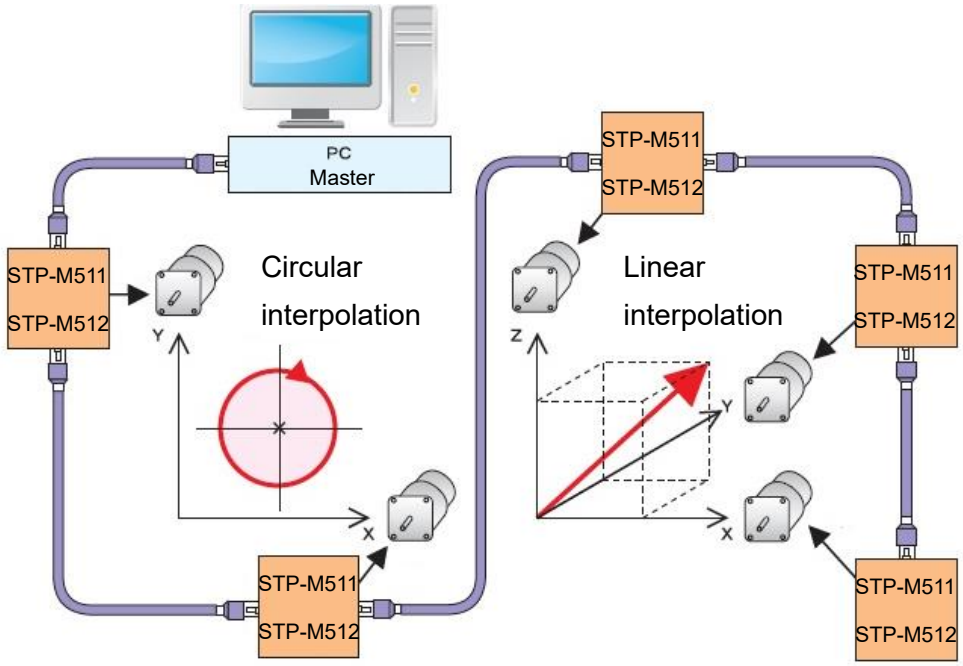


1.2.1. Motionnet Communications

Motionnet is a high-speed serial communication system. This serial communication system is a complete system affording remote operation of emulating a CPU and handling CPU message communications by serial communication at transfer speeds of 20 Mbps as well as I/O control.

STP-M51x is equipped with G9103C, which is one of the motion control LSIs in Motionnet.
G9103C can perform all of the pulse-train input controls such as constant speed operation, linear acceleration/deceleration, S-curve acceleration/deceleration, as well as a preset positioning operation, and an origin return operation, which are required by motion controls.

Two-axis circular interpolation or linear interpolation of maximum 32 axes among each motor can be achieved.



- Data transfer speed
  Maximum is 20 Mbps. Default speed is 10Mbps.

- Number of devices that can be connected
  Maximum 32 STP-M510A, STP-M511A or STP-M512A / ring
- The maximum total extension distance
  - Max. 100 m (Transfer speed; 20 Mbps with 32 local boards connected)
  - Max. 50 m (Transfer speed; 20 Mbps with 64 local boards connected)

- Max. 100 m (Transfer speed; 10 Mbps with connecting 64 local boards connected)
- Minimum cable length: 60 cm long.

- Cyclic communication time and transfer cycle
  Cyclic communication time
  Maximum 15.1 μs/ unit (Data transfer speed: 20 Mbps)
  Cyclic data transfer cycle
  Maximum 0.97 ms / when connected to 64 local devices (Data transfer speed 20 Mbps)
  (As the number of devices connected grows smaller, the transfer speed gets proportionally faster.)

1.2.2. Motion control

- Command pulse output
  Support 1P signal - Pulse / Dir mode.

- Acceleration/deceleration control
  Both linear and S-curve acceleration/deceleration is available. The S-curve acceleration/deceleration also allows use of linear acceleration/deceleration parts.

- Speed override
  The speed can be changed during any operation in all the modes.

- Overriding the target position
  The target position (feed amount) can be changed during positioning using the positioning mode function. When a feed operation has already passed the new target position, the motor will decelerate and stop (stop immediately when performing a constant speed operation), and start to feed in the opposite direction.

- Backlash correction
  The driver has a backlash correction function.
  The backlash correction function corrects feed amount each time the feed direction changes.

- 13 homing modes of zero return sequences

  Refer to “Motionnet Programming Manual” to get more detail information about motion control

1.2.3. Motor driver

- Required power
  This board requires 24 VDC±10% for main power.
  I/O isolated interface requires 24 VDC±10%.

- A motor that can be controlled
  5-phase stepper motor

- Driving method
  Constant-current Driving System

- Microstep
  Select from 16 steps (division by 1, 2, 5, 10, 25, 50, 250, 3, 4, 6, 12, 24, 36 and 72)

1.3. Specifications

Motionnet	
Communication controller	Motionnet slave motion controller ASIC
Serial interface	RS-485 with transformer isolation
Cable type	CAT5 UTP/STP Ethernet cable
Transmission speed	2.5Mbps, 5Mbps, 10Mbps and 20Mbps
Multi Axes Drive	Max. 32 Slaves/Ring

5 Phase Driver	
Drive model	5-phase Constant-current
Motor Type	5-phase 0.36° and 0.72° step angle
Micro step	1, 2, 5, 10, 25, 50, 250, 3, 4, 6, 12, 24, 36 and 72
Driving Current Setting	STP-K510A – Max. 0.75A STP-K511A – Max. 1.4A STP-K512A – Max. 2.8A RUN: 0~F by rotary switch STOP: 0~F by rotary switch
Resolution	500 1,000 ~ 125,000 pulse/revolution
I/O input signal	PEL, MEL, ORG, EMG and LTC
I/O output signal	CMP, DO(for brakes, 250mA)
Position control	Incremental / Absolute mode, Data range 32bits
LED indicator	PWR, RUN, ERR, PEL, MEL, ORG, INP, SVON, ALM, EMG
Software	Motion library (DLL) for Win XP/7/10
Input voltage	24 VDC±10% for main power. I/O isolated interface requires 24 VDC±10%.
Current consumption	3.1W typical (130mA/24V) no load
Working temperature	0°C~50°C (32°F~122°F) ambient temperature with air flow
Storage temperature	-20°C~80°C (-4°F~176°F)
Humidity	85% (non-condensing @60°C)

1.3.1. Packing List

STP-K510A, STP-K511A

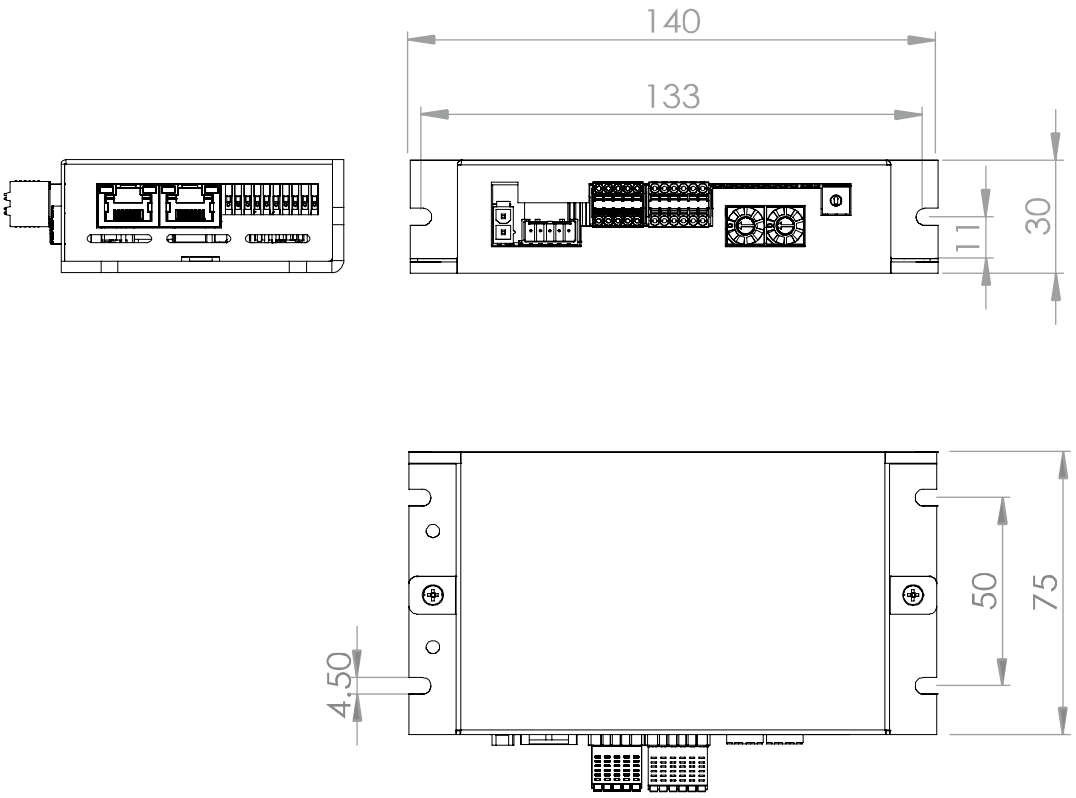
Item	Description	Qty.
MOLEX 5557-02R Housing	Power Connector	1
MOLEX 5556T2 Terminal	Power Connector	2
MOLEX 51103-0500 Housing	Motor Connector	1
MOLEX 50351-8000 Terminal	Motor Connector	5
DINKLE 0156-1B10 Connector	Encoder Connector	1
DINKLE 0156-1B12 Connector	MI/O Connector	1

STP-K512A

Item	Description	Qty.
MOLEX 5557-02R Housing	Power Connector	1
MOLEX 5556T2 Terminal	Power Connector	2
MOLEX 51067-0500 Housing	Motor Connector	1
MOLEX 50217-9001 Terminal	Motor Connector	5
DINKLE 0156-1B10 Connector	Encoder Connector	1
DINKLE 0156-1B12 Connector	MI/O Connector	1

2. Hardware Specifications

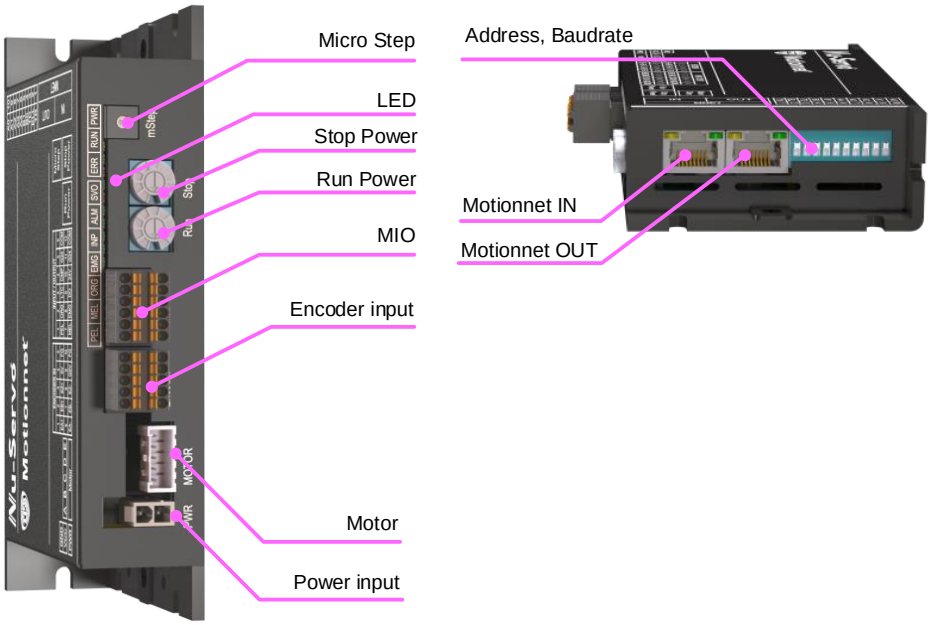
2.1. Mechanical Dimensions



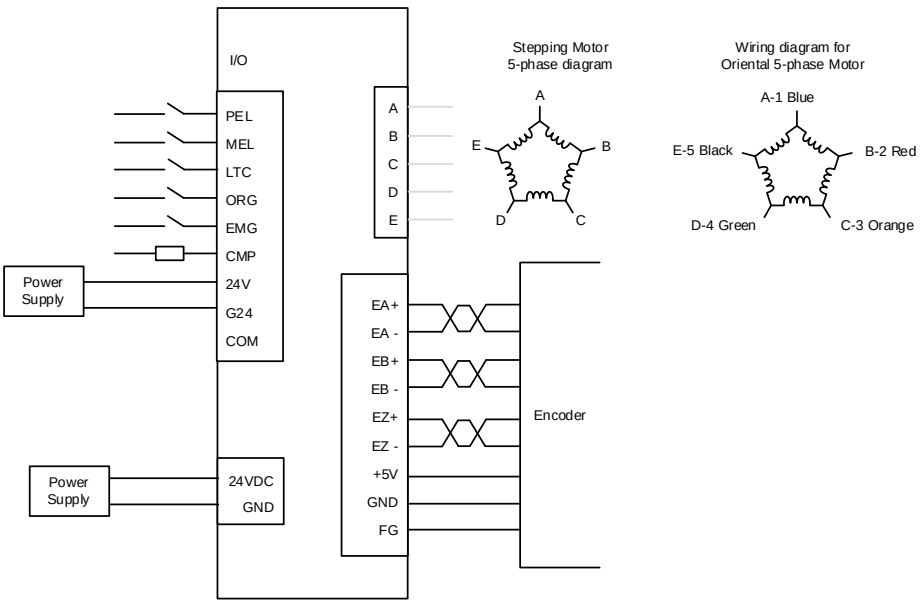
Unit: mm

2.2. System Connection

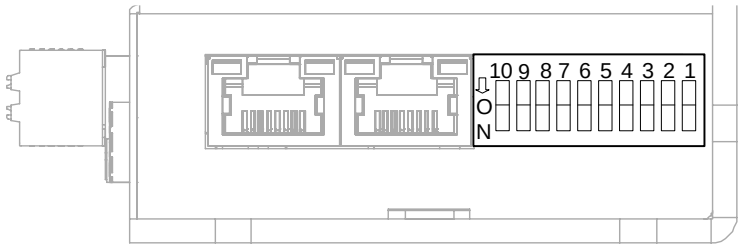
The STP-M51xA not only controls the stepper motors, but also supports encoder feedback signals. The wiring definition is illustrated in the following figure.



2.3. System Diagram

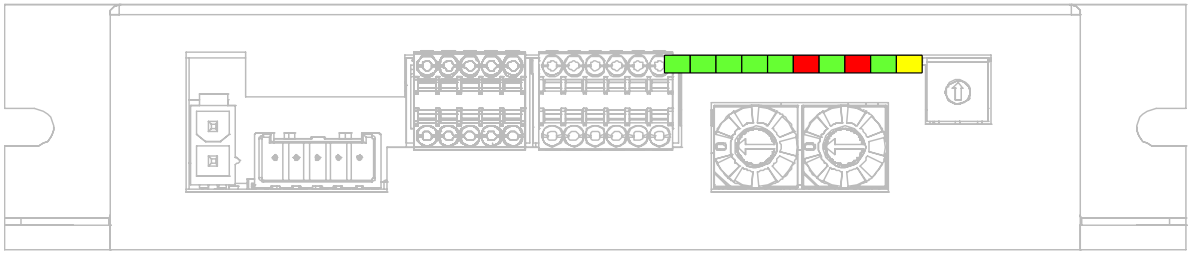


2.3.1. Motionnet Setting



<table>
<tr><th>Number</th><th>Name</th><th>Description</th></tr>
<tr><td>10</td><td>TR</td><td>Setting of the terminal resistance. Default setting is off.
<table>
<tr><th>TR</th><th>Logic</th></tr>
<tr><td>OFF</td><td>No terminal resistance added.</td></tr>
<tr><td>ON</td><td>Add a terminal resistance.</td></tr>
</table></td></tr>
<tr><td>9</td><td>ELL</td><td>Setting the logic of positive and negative limits. Default setting is off.
<table>
<tr><th>EL</th><th>Logic</th></tr>
<tr><td>OFF</td><td>Normal open.</td></tr>
<tr><td>ON</td><td>Normal close.</td></tr>
</table></td></tr>
<tr><td>8</td><td>TD</td><td>Keep or reset status while disconnect. Default setting is off.
<table>
<tr><th>TD</th><th>Logic</th></tr>
<tr><td>OFF</td><td>Keep Status.</td></tr>
<tr><td>ON</td><td>Reset Status.</td></tr>
</table></td></tr>
<tr><td>7, 6</td><td>B0, B1</td><td>Setting of transfer rate. Default value is 10Mbps.
<table>
<tr><th>B0</th><th>B1</th><th>Transfer rate</th></tr>
<tr><td>OFF</td><td>OFF</td><td>20Mbps</td></tr>
<tr><td>ON</td><td>OFF</td><td>10Mbps</td></tr>
<tr><td>OFF</td><td>ON</td><td>5Mbps</td></tr>
<tr><td>ON</td><td>ON</td><td>2.5Mbps</td></tr>
</table></td></tr>
<tr><td>5-1</td><td>A4-A0</td><td>Device IP address
IP = 1*A0 + 2*A1 + 4*A2 + 8*A3 + 16*A4</td></tr>
</table>

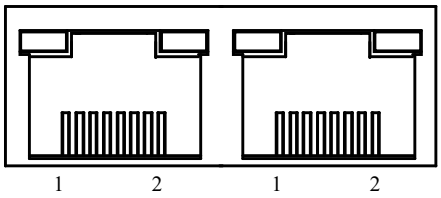
2.3.2. LED Indicators



PEL	MEL	ORG	EMG	INP	ALM	SVON	ERR	RUN	PWR

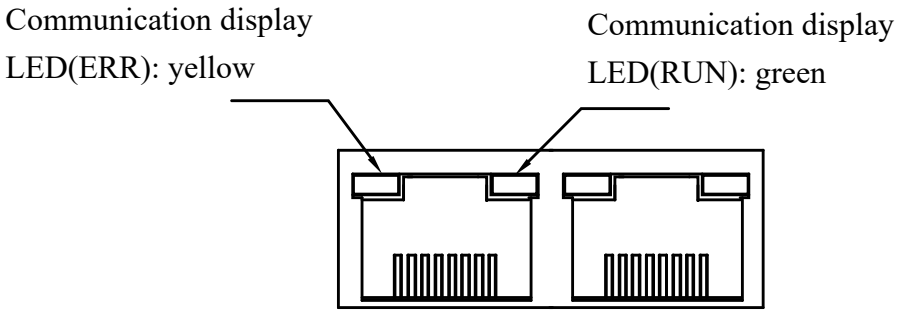
LED	Color	Description	Function
PWR	Yellow	Power On	Lights on when Power is on.
RUN	Green	Slow Down On	Lights on when Motionnet runs.
ERR	Red	Emergency On	Lights on when Motionnet error occurs.
SVO	Green	Servo On	Lights on when Servo on.
ALM	Red	Alarm On	Off - No Alarm Flash - Over Temperature (>80°C) Last On - Over Current
INP	Green	In-Position On	Lights on when INP on.
EMG	Green	Emergency On	Lights on when connected to G24. (NPN) Lights on when connected to 24V. (PNP)
ORG	Green	ORG On	
MEL	Green	Negative limit	
PEL	Green	Positive limit	

2.3.3. Motionnet Connection



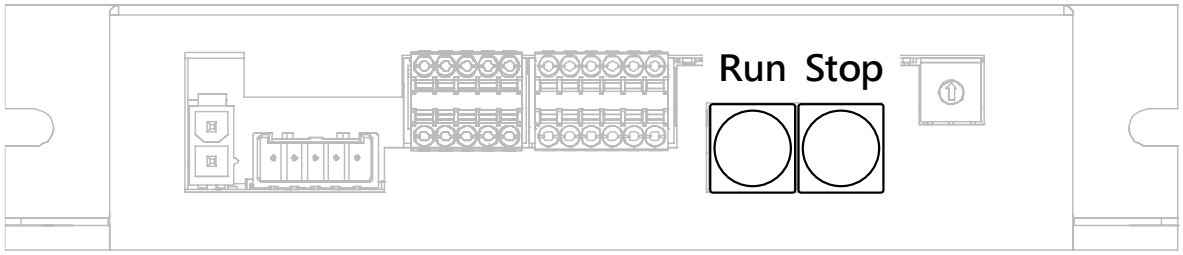
Pin	Pin Mark	Pin Description
1	NC	Reserved
2	NC	Reserved
3	RS485+	Motionnet protocol +
4	NC	Reserved
5	NC	Reserved
6	RS485-	Motionnet protocol -
7	NC	Reserved
8	NC	Reserved

■ PIN Definition



Communication display LED signals of RJ45 are connected internally, therefore, both LEDs light simultaneously.

2.3.4. Driving Current Switch



Run setting	Run Current (A)			Stop setting	Stop Current Rate (%)		
	M510A	M511A	M512A		M510A	M511A	M512A
0 (default)	0.15	0.35	0.72	0 (default)	30	23	23
1	0.19	0.42	0.86	1	34	28	28
2	0.23	0.49	1.00	2	39	33	33
3	0.27	0.56	1.14	3	44	39	39
4	0.31	0.64	1.28	4	50	45	45
5	0.35	0.71	1.42	5	55	50	50
6	0.39	0.79	1.58	6	59	55	55
7	0.43	0.86	1.72	7	64	60	60
8	0.47	0.93	1.86	8	70	65	65
9	0.51	1.00	2.00	9	74	70	70
A	0.55	1.06	2.12	A	78	74	74
B	0.59	1.13	2.26	B	82	78	78
C	0.63	1.21	2.42	C	88	83	83
D	0.67	1.27	2.54	D	92	87	87
E	0.71	1.33	2.66	E	96	91	91
F	0.75	1.4	2.80	F	100	95	95

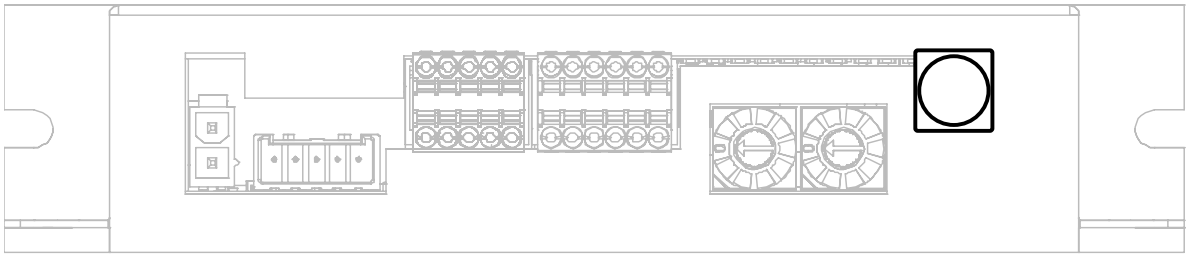
E.g.

Set Run as 9 and Stop as 5.

Motor Run Current is 1A/phase and Stop Current is 0.5A/phase ± 0.14A.

(=1A/phase*50% ± 0.14A)

2.3.5. Microstep Setting



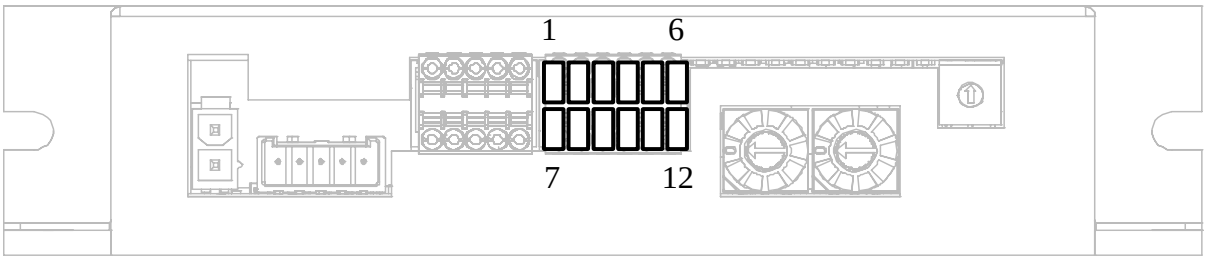
Switch	Microstep divider	Pulses per revolution
0	1	500
1	2	1,000
2	5	2,500
3	10 (Default)	5,000
4	25	12,500
5	50	25,000
6	Reserved	Reserved
7	250	125,000
8	3	1,500
9	4	2,000
A	6	3,000
B	12	6,000
C	Reserved	Reserved
D	24	12,000
E	36	18,000
F	72	36,000

Note.

5-phase step motor basic step angle is 0.72° (500 steps/revolution).

If apply to 0.36° (1000 steps/revolution) motor, pulse per revolution becomes twice.

2.3.6. Mechanical Input (MIO)



■ PIN Definition

Pin	Name	Function	I/O
1	PEL	Positive limit	I
2	ORG	Home position	I
3	LTC	Latch Input	I
4	CMP	Comparator output	O
5	G24	DC 24V Input Ground	I
6	COM	Common Contact	I
7	MEL	Negative limit	I
8	EMG	Emergency Stop	I
9	DO	Digital Output	I
10	24V	DC 24V Input	I
11	G24	DC 24V Input Ground	I
12	COM	Common Contact	I

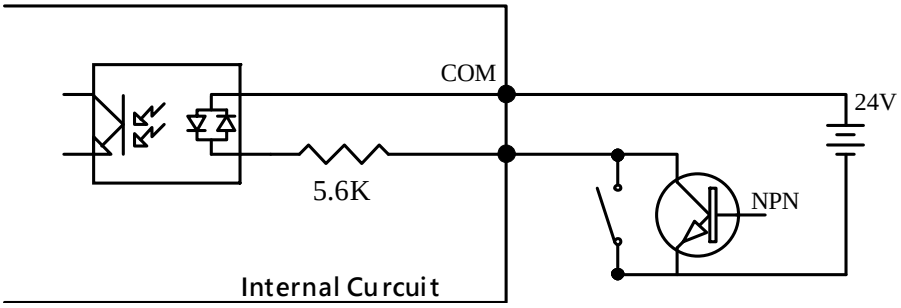
Note

1. Wiring COM contact to 24V or G24 to decide NPN or PNP interface of EL+, EL-, ORG and EMG.
2. EMG signal needs to be inactive to drive the motor. Otherwise the driver will be in the emergent stop state.
3. MIO needs DC24V power input to drive isolated interface.
4. DO output capacity is 250mA.

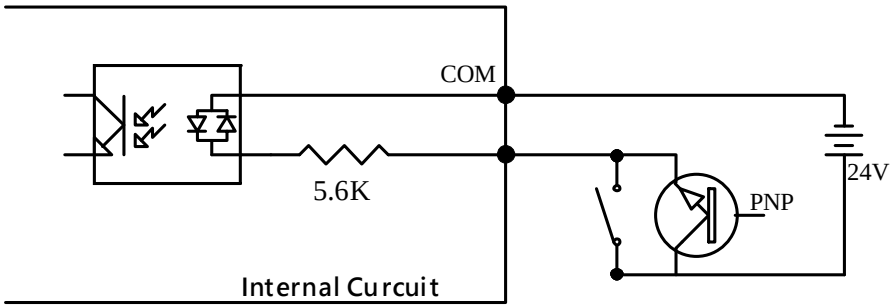
■ EMG (Emergency Stop / Digital Input Signal)

There is emergency stop input pin for this module. When EMG is active, all the motion pulse output command will be rejected until the EMG is deactive. The emergency stop switch should have a Normal-Closed type contact switch.

NPN wiring



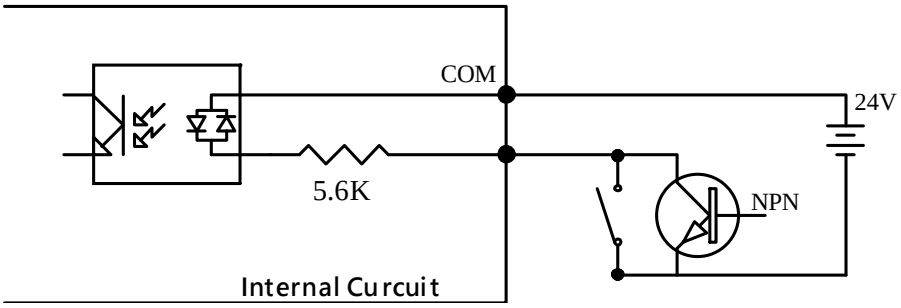
PNP wiring



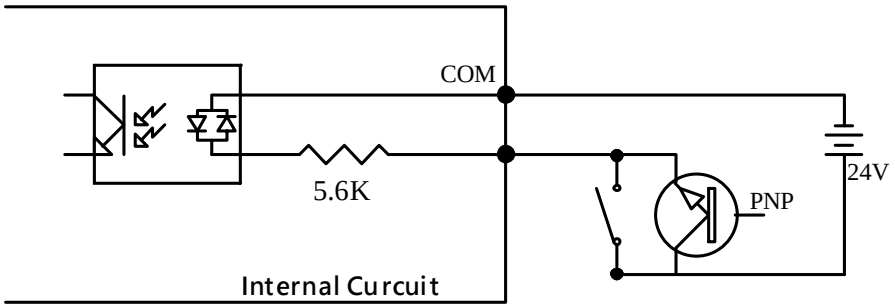
■ PEL and MEL (End Limit / Digital Input Signal)

There are two end-limit signals called PEL and MEL for each axis. Usually they are Normal-Close type signals from external sensors. PEL indicates the limit of motion in the plus direction and MEL indicates the limit of motion in the minus direction.

NPN wiring



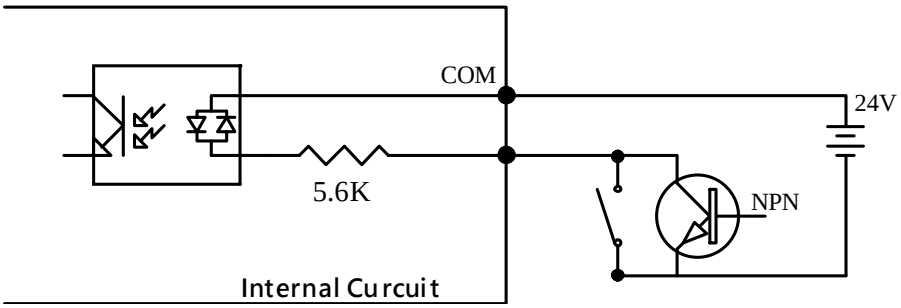
PNP wiring



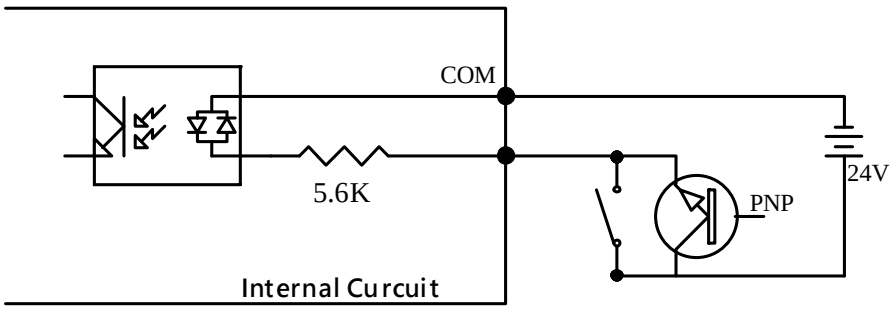
■ ORG (Origin / Digital Input Signal)

The origin signal is necessary when the position feedback is incremental type or without any feedback encoders. They are used to indicate the origin of the system.

NPN wiring



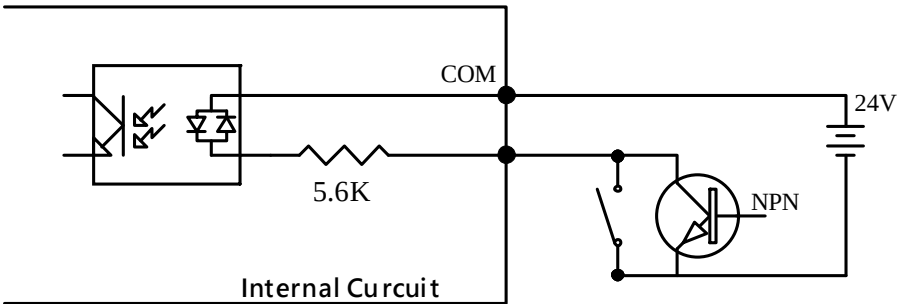
PNP wiring



- LTC (Counter Latch, Digital Input)

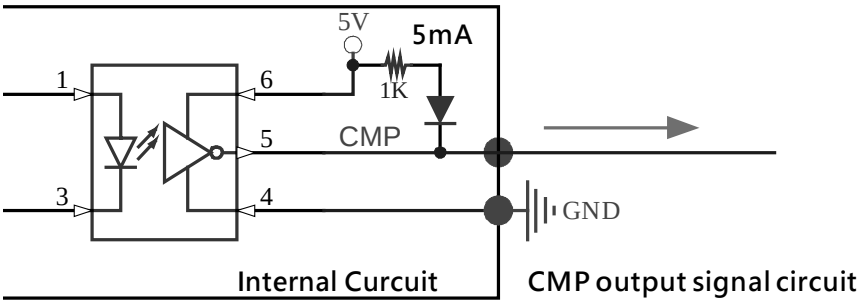
  LTC is used to latch the value in the counter when the LTC input is active.

  NPN wiring



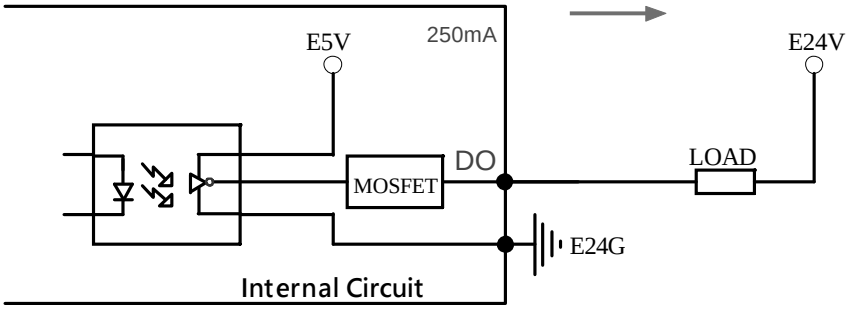
- CMP (Position Compare / Output Signal)

  CMP signals are used to make a comparison between target value and actual value and generate a trigger signal output. Trigger signal width is fixed at 33 micro-second.

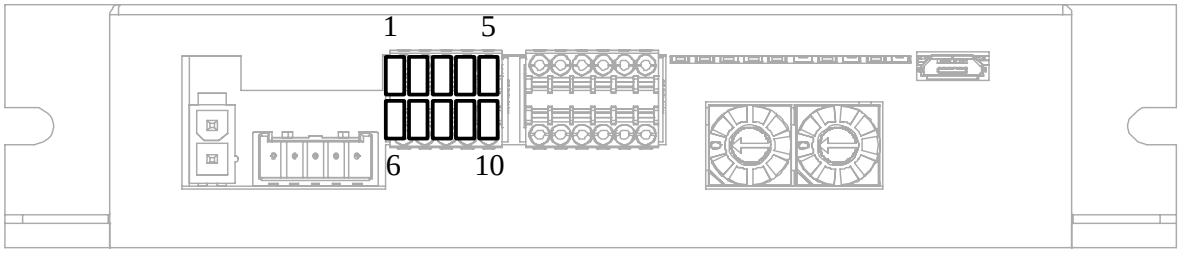


- DO (Position Compare / Output Signal)

  CMP signals are used to make a comparison between target value and actual value and generate a trigger signal output. Trigger signal width is fixed at 33 micro-second.

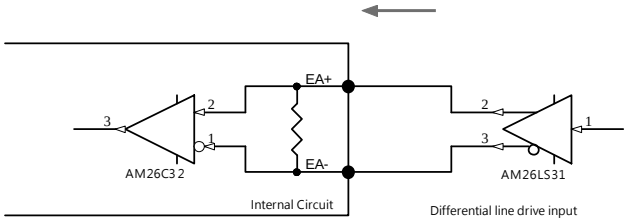


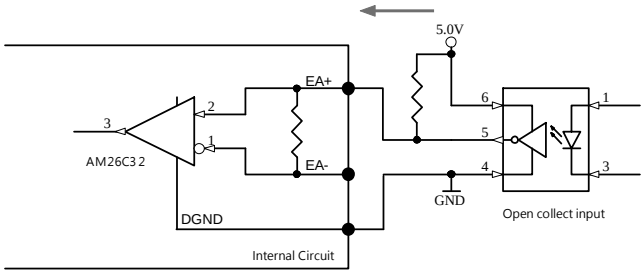
2.3.7. Encoder Input



Pin	Name	Function	I/O	Pin	Name	Function	I/O
1	EA+	Encoder phase A input (+)	I	6	EA-	Encoder phase A input (-)	I
2	EB+	Encoder phase B input (+)	I	7	EB-	Encoder phase B input (-)	I
3	EZ+	Encoder phase Z input (+)	I	8	EZ-	Encoder phase Z input (-)	I
4	D5V	DC 5V Output	O	9	G5V	DC 5V Ground	O
5	FG	Frame ground	-	10	FG	Frame ground	-

If the rotary encoder or linear scale are with a line driver output equivalent to 26C31, that could be connected directly to the module.



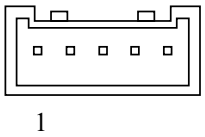


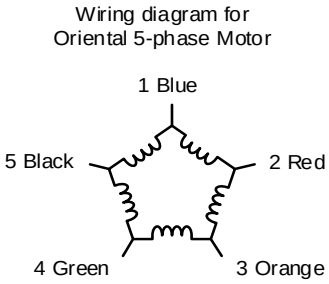
Note *DC 5V output capacity is 100mA.*

Note *DC 5V is converted from DC24V input.*

2.3.8. Motor Connector

■ PIN Definition





Pin No.	Function
1	Phase A
2	Phase B
3	Phase C
4	Phase D
5	Phase E

■ Connector for Cable

Manufacturer: MOLEX

STP-M510A.M511A

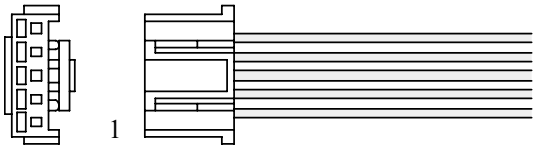
Housing: 51103-0500

Terminal: 50351-8000

STP-M512A

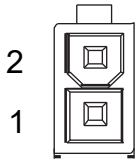
Housing: 51067-0500

Terminal: 50217-9001



2.3.9. Power Input

■ PIN Definition



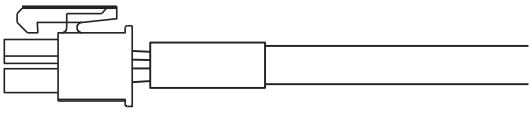
Pin No.	Function
2	Power input: GND
1	Power input: 24 VDC

■ Connector for Cable

Manufacturer: MOLEX

Housing: 5557-02R

Terminal: 5556T2



2.4. Mounting Direction and Spacing

It is recommended to reserve enough surrounding space for effective cooling.

Make sure that if the fans installed in the cabinet have sufficient space to take in and exhaust the cooling air.

In addition pay attention to the direction of air flow through internally installed fans.