HIWIN® MIKROSYSTEM

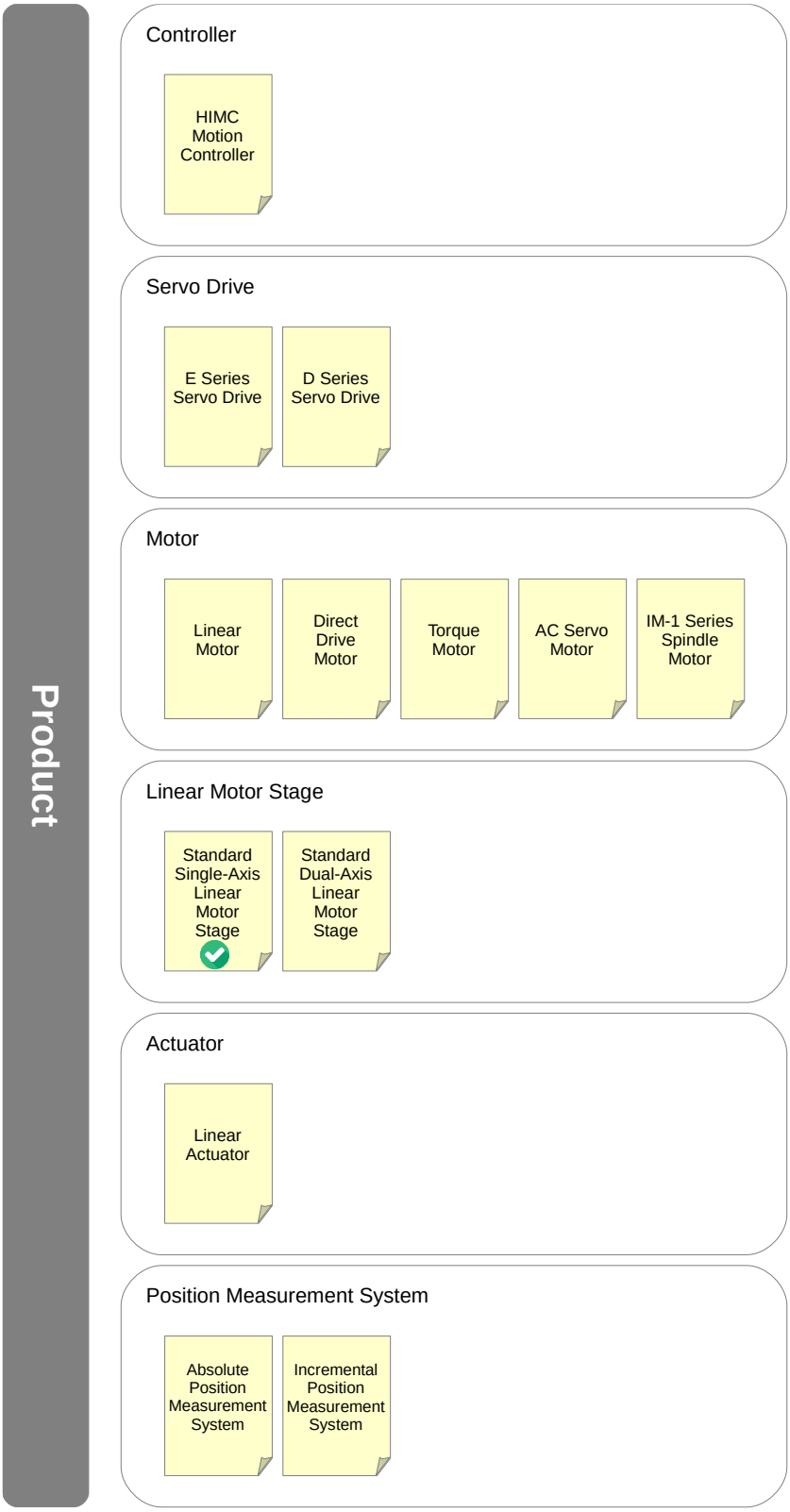
Nano Precision Stage

User Manual

www.hiwinmikro.tw
MM14UE01-2412_V1.0

Related Documents

Through related documents, users can quickly understand the positioning of this manual and the correlation between manuals and products. Go to HIWIN MIKROSYSTEM's official website → Download → Manual Overview for details (https://www.hiwinmikro.tw/Downloads/ManualOverview_EN.htm).



Product		Doc. Name		Doc. No.	Content
Controller	HIMC Motion Controller	HIMC Installation Guide		MH07UE01-□□□□	Provides detailed information on installing and connecting HIMC motion controller.
		HIMC iA Studio User Guide		MH01UE01-□□□□	Provides detailed information on the human machine interface operation of HIMC motion controller.
		HIMC Modbus TCP User Guide		MH02UE01-□□□□	Provides detailed information on the way Modbus TCP communication protocol applied to HIMC motion controller.
		HIMC HMPL User Guide		MH06UE01-□□□□	Provides detailed information on HMPL library of HIMC motion controller.
		HIMC API Reference Guide		MH05UE01-□□□□	Provides detailed information on API library of HIMC motion controller.
		HIOM Installation Guide		MH03UE01-□□□□	Provides detailed information on installing and connecting HIOM (HIWIN mega-ulink IO module).
		ETA3 Installation Guide		MH09UE01-□□□□	Provides detailed information on installing and connecting ETA3 (HIMC remote module).
Servo Drive	E Series Servo Drive	Technical Manuals	E1 Series Servo Drive User Manual	MD09UE01-□□□□	Provides detailed information on selecting, installing, connecting, setting, performing test run for, tuning, and monitoring E1 series servo drive.
			E2 Series Servo Drive User Manual	MD28UE01-□□□□	Provides detailed information on selecting, installing, connecting, setting, performing test run for, tuning, and monitoring E2 series servo drive.
			E Series Servo Drive Thunder Software Operation Manual	MD12UE01-□□□□	Provides detailed information on the human machine interface operation of E series servo drive.
			E Series Servo Drive Gantry Control System User Manual	MD22UE01-□□□□	Provides detailed information on the usage of E series servo drive gantry control system.
			E Series Servo Drive Electronic Cam Control System User Manual	MD27UE01-□□□□	Provides detailed information on the usage of E series servo drive electronic cam control system.
			E Series Servo Drive Multi-Motion Function User Manual	MD32UE01-□□□□	Provides detailed information on the usage of E series servo drive multi-motion function.
			MPI Library Reference Manual	MD19UE01-□□□□	Provides detailed information on MPI library of E series servo drive and D series servo drive.
			MPI Examples	MD18UE01-□□□□	Provides detailed information on MPI examples of E series servo drive and D series servo drive.
			API Library Reference Manual for Servo Drives	MD23UE01-□□□□	Provides detailed information on API library of E series servo drive and D series servo drive.
			PDL Examples for E Series Servo Drive	MD25UE01-□□□□	Provides detailed information on PDL examples of E series servo drive.
		Communication Manuals	E Series Servo Drive EtherCAT(CoE) Communications Command Manual	MD08UE01-□□□□	Provides detailed information on the way EtherCAT communication protocol applied to E series servo drive.
			E1 Series Servo Drive MECHATROLINK-III Communication Command Manual	MD24UE01-□□□□	Provides detailed information on the way MECHATROLINK-III communication protocol applied to E1 series servo drive.
			E1 Series Servo Drive PROFINET Communication Command Manual	MD02UE01-□□□□	Provides detailed information on the way PROFINET communication protocol applied to E1 series servo drive.

Product		Doc. Name		Doc. No.	Content
		Application Manuals	E2 Series Servo Drive Replacement Guide	MD34UE01-□□□□	Provides detailed information on the way of replacing E1 series servo drive and D1 series servo drive with E2 series servo drive.
			Application Note E1 PROFINET Drive Complete Setup with Siemens TIA Portal	MD30UE01-□□□□	Provides detailed information on the operation of PLC software TIA Portal when E1 PROFINET drive is used with Siemens S7 series PLC.
			Application Note E1 MECHATROLINK-III Drive Complete Setup with YASKAWA MPE720	MD31UE01-□□□□	Provides detailed information on the operation of machine controller software MPE720 when E1 MECHATROLINK-III drive is used with YASKAWA MP3000 series machine controller.
			Function Blocks Application Manual E Series EtherCAT Drive with OMRON Sysmac Studio	MD35UE01-□□□□	Provides detailed information on the usage of application function blocks when E series EtherCAT drive is used with OMRON Sysmac Studio.
			Function Blocks Application Manual E Series EtherCAT Drive with KEYENCE KV STUDIO	MD36UE01-□□□□	Provides detailed information on the usage of application function blocks when E series EtherCAT drive is used with KEYENCE KV STUDIO.
Servo Drive	D Series Servo Drive	D1 Servo Drive User Manual		MD20UE01-□□□□	Provides detailed information on selecting, installing, connecting, setting, performing test run for, tuning, and monitoring D1 servo drive.
		D2 Series Servo Drive User Manual		MD07UE01-□□□□	Provides detailed information on selecting, installing, connecting, setting, performing test run for, tuning, and monitoring D2T servo drive.
		D2T-LM Series Servo Drive User Manual		MD11UE01-□□□□	Provides detailed information on selecting, installing, connecting, setting, performing test run for, tuning, and monitoring D2T-LM servo drive.
		MPI Library Reference Manual		MD19UE01-□□□□	Provides detailed information on MPI library of E series servo drive and D series servo drive.
		MPI Examples		MD18UE01-□□□□	Provides detailed information on MPI examples of E series servo drive and D series servo drive.
		API Library Reference Manual for Servo Drives		MD23UE01-□□□□	Provides detailed information on API library of E series servo drive and D series servo drive.
		PDL Examples for D-series Drives User Manual		MD13UE01-□□□□	Provides detailed information on PDL examples of D series servo drive.
Motor	Linear Motor	Linear Motor User Manual		MP99UE01-□□□□	Provides detailed information on selecting, installing, and connecting linear motor.
	Direct Drive Motor	DMN Series Direct Drive Motor User Manual		MR01UE01-□□□□	Provides detailed information on selecting, installing, and connecting DMN series direct drive motor.
		DMT Series Direct Drive Motor User Manual		MR03UE01-□□□□	Provides detailed information on selecting, installing, and connecting DMT series direct drive motor.
		DMY Series Direct Drive Motor User Manual		MR04UE01-□□□□	Provides detailed information on selecting, installing, and connecting DMY series direct drive motor.
		DMS Series Direct Drive Motor User Manual		MR05UE01-□□□□	Provides detailed information on selecting, installing, and connecting DMS series direct drive motor.
		DMR Series Direct Drive Motor User Manual		MR06UE01-□□□□	Provides detailed information on selecting, installing, and connecting DMR series direct drive motor.

Product		Doc. Name	Doc. No.	Content
		DMH Series Direct Drive Motor User Manual	MR07UE01-□□□□	Provides detailed information on selecting, installing, and connecting DMH series direct drive motor.
	Torque Motor	Torque Motor User Manual	MW99UE01-□□□□	Provides detailed information on selecting, installing, and connecting torque motor.
	AC Servo Motor	E1 Series AC Servo Motor User Manual	MC03UE01-□□□□	Provides detailed information on selecting, installing, and connecting E1 series AC servo motor.
	IM-1 Series Spindle Motor	IM-1 Series Spindle Motor User Manual	MS01UE01-□□□□	Provides detailed information on selecting and installing IM-1 series spindle motor.
Linear Motor Stage	Standard Single-Axis Linear Motor Stage	Standard Single-Axis Linear Motor Stage User Manual	MM06UE01-□□□□	Provides detailed information on selecting, installing, and connecting standard single-axis linear motor stage.
		Nano Precision Stage User Manual	MM14UE01-□□□□	Provides detailed information on selecting, installing, and connecting nano precision stage.
	Standard Dual-Axis Linear Motor Stage	Standard Dual-Axis Linear Motor Stage User Manual	MM18UE01-□□□□	Provides detailed information on selecting, installing, and connecting standard dual-axis linear motor stage.
Actuator	Linear Actuator	Linear Actuator User Manual	MA99UE18-□□□□	Provides detailed information on selecting, installing, and connecting linear actuator.
Position Measurement System	Absolute Position Measurement System	Absolute Position Measurement System User Manual	ME06UE01-□□□□	Provides detailed information on selecting, installing, and connecting absolute position measurement system.
	Incremental Position Measurement System	Incremental Position Measurement System User Manual	ME07UE01-□□□□	Provides detailed information on selecting, installing, and connecting incremental position measurement system.

Approvals

Stage series	Approvals	
	EU Directives	UL Approvals

Table of Contents

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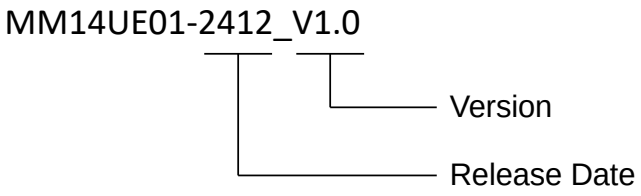
1. General information

1.1 Revision history

The version of the manual is also indicated on the bottom of the front cover.



Release Date	Version	Applicable Product	Revision Contents
Dec. 05th, 2024	1.0	Nano Precision Stage	First edition.

1.2 About this manual

This manual aims to assist users to operate Nano Precision Stage (NPS). The contents of this manual, including general information, basic safety information, product description, transport and setup, assembly and connection, commissioning, maintenance & cleaning, disposal, troubleshooting, declaration of incorporation and appendix, are arranged in accordance with the procedure of configuring a machine. Please read through this manual to operate Nano Precision Stage (NPS) correctly.

1.3 General precautions

Before using the product, please carefully read through this manual. HIWIN MIKROSYSTEM is not responsible for any damage, accident or injury caused by failure in following the installation instructions and operating instructions stated in this manual.

- Before installing or using the product, ensure there is no damage on its appearance. If any damage is found after inspection, please contact HIWIN MIKROSYSTEM or local distributors.
- Do not disassemble or modify the product. The design of the product has been verified by structural calculation, computer simulation and actual testing. HIWIN MIKROSYSTEM is not responsible for any damage, accident or injury caused by disassembly or modification done by users.
- Ensure the wiring is not damaged and can be normally connected.
- Keep children away from the product.
- Anyone with psychosomatic illness or insufficient experience should not use the product alone. The supervision of managers or product docents is definitely needed.
- If the product information does not match your order, please contact HIWIN MIKROSYSTEM or local distributors.

HIWIN MIKROSYSTEM offers 1-year warranty for the product. The warranty does not cover damage caused by improper usage (refer to the precautions and instructions stated in this manual) or natural disaster.

1.3.1 Requirements

We assume that

- Operating staff are trained in the safe operation practices for NPS and have read and understood this user manual in full.
- Maintenance staff maintain and repair the NPS in such a way that they pose no danger to people, property or the environment.

1.4 Safety instruction

- Depictions used in this user manual:
  - Instructions:
    Instructions are indicated by diamond point.
    Example:
    - ◆ Assemble the stators carefully!
    - ◆ Do not place fingers or objects between the stators!

    Instructions are indicated by number in the order in which they are to be carried out.
    Example:
    Steps to transport the NPS:
    (1). Disconnect power supply.
    (2). Disconnect stage cables.
    (3). Remove the payload.

  - Lists:
    Lists are indicated by square point.
    Example:
    The NPS must not be operated:
    - Outdoor
    - In potentially explosive atmospheres

  - Information:
    Information is to describe general information and recommendations.
    Example:
    Note: Please contact HIWIN for special requests.

- Carefully read through this manual before installation, transportation, maintenance and examination. Ensure the product is correctly used.

- Carefully read through electromagnetic (EM) information, safety information and related precautions before using the product.

- Safety precautions in this manual are classified into “DANGER”, “WARNING” and “CAUTION”.

DANGER

Imminent danger!

Indicates that death or severe personal injury will result if proper precautions are not taken.

WARNING

Potentially dangerous situation!

Indicates that death or severe personal injury may result if proper precautions are not taken.

CAUTION

Potentially dangerous situation!

Indicates that property damage or environmental pollution can result if proper precautions are not taken.

Warning Signs


No access for people with active implanted cardiac devices.


Substance hazardous to the environment!


Warning!


Warning of crushing of hands!


Warning of electricity!


Warning of hot surface!


Warning of magnetic field!

Mandatory Signs


Wear head protection!


Refer to user manual!


Wear protective gloves!


Disconnect before carrying out maintenance or repair.


Wear safety footwear!


Lifting point.

■ Basic safety notices

⚠DANGER

Danger from strong magnetic fields!

Strong magnetic fields around NPS pose a health risk to a person with implants (e.g. cardiac pacemakers) that are affected by magnetic fields.

- ◆ Anyone with implants that are affected by magnetic fields should maintain a safe distance of at least 500 mm from NPS.

⚠WARNING

Risk of Linear motor operate.

When incorrectly operated and in the case of a fault, the motor can overheat resulting in fire and smoke. This can result in severe injury or death.

Excessively high temperatures may destroy motor components and result in increased failures as well as shorter service life of motors.

- ◆ Operate the motor according to the relevant specifications.
- ◆ Allow the forcer to cool down sufficiently (in a 25°C room temperature) before working around the product to avoid burns.
- ◆ When an abnormal smell, noise, smoke, or vibration is detected, please turn off the power immediately.

⚠CAUTION

Risk of physical damage to watches and magnetic storage media.

Strong magnetic forces may destroy watches and magnetizable data storage media near to the NPS!

- ◆ Do not bring watches or magnetizable data storage media close to (<500 mm) the NPS!

■ Transport to the installation site

⚠WARNING

Risk of crushing from forcer housing!

Danger of injury from crushing and damage to the NPS caused by movement of the forcer housing due to gravity, as it does not feature brakes in its standard version.

- Ensure that each transportation safety devices are well fixed before transportation. In most cases, the devices are made in red.

⚠WARNING

Danger from heavy loads!

- Lifting heavy loads may damage your health.
- For system's weight over 20 kg, use a hoist of an appropriate size when positioning heavy loads!
- Check applicable occupational health and safety regulations when handling suspended loads!

■ Assembly and connection

⚠DANGER

Danger from electrical voltage!

Before and during assembly, disassembly and repair work, dangerous currents may flow.

- Work may only be carried out by a qualified electrician and with the power supply disconnected!
- Before carrying out work on the NPS, disconnect the power supply and protect it from being switched back on!

⚠DANGER

Risk of crushing from strong forces of attraction!

There is a risk of crushing from the strong forces of attraction emitted by the stators, as they are assembled with opposing polarity!

- Assemble the stators carefully!
- Do not place fingers or objects between the stators!

⚠WARNING

Risk of crushing from forcer housing!

Danger of injury from crushing and damage to the NPS caused by movement of the forcer housing due to gravity, as it does not feature brakes in its standard version.

- ◆ Ensure that the NPS does not exceed 1° horizontal deviation!

⚠WARNING

Risk of crushing from the forcer!

Danger of injury from crushing and damage to the forcer through uncontrolled movements during assembly.

- ◆ Ensure that the forcer is locked in place during assembly using transportation safety devices!

⚠WARNING

Risk of crushing from strong forces of attraction!

Danger of injury from crushing and damage to the forcer or stator caused by very strong forces of attraction.

- ◆ Ensure that the forcer only comes close to the stator when the linear guideways can absorb the forces!

■ Electrical connection

⚠DANGER

Danger from electrical voltage!

If linear motors are incorrectly grounded, there is a danger of electric shock.

- ◆ Before connecting the electrical power supply, ensure that the NPS is correctly grounded.

⚠DANGER

Danger from electrical voltage!

Electrical currents may flow even if the motor is not moving.

- ◆ Ensure that the NPS is disconnected from the power supply before the electrical connections are detached from the motors.
- ◆ After disconnecting the drive amplifier from the power supply, wait at least 5 minutes before touching live parts or breaking connections.
- ◆ For safety reasons, measure the voltage in the intermediate circuit and wait until it has fallen below 40V.

■ Switch on the NPS

⚠WARNING

Risk of crushing from strong forces of attraction!

Strong magnetic forces may attract steel or iron objects from the NPS and cause crushing!

- ◆ No heavy (> 1 kg) or large (> 0.01 m²) steel or iron objects should be introduced by hand into the immediate surrounding area (50 mm) of the magnet track!
- ◆ Use suitable tools only.

⚠WARNING

Risk of crushing from moving forcer housing!

The forcer housing may cause damage to parts through its movement at the end position of the machine.

- ◆ The operator should provide protective equipment to prevent from reaching into the danger area of the machine!

⚠WARNING

Risk of burns!

The motor heats up during operation and thus touching the motor can lead to burns!

- ◆ Provide protective devices and warning notices at the motor!

■ Maintenance and cleaning

DANGER

Danger from electrical voltage!

Before and during maintenance and cleaning, dangerous currents may flow.

- Work may only be carried out by a qualified electrician and with the power supply disconnected!
- Before carrying out work on the NPS, disconnect the power supply and protect it from being switched back on!

WARNING

Risk of crushing from moving parts!

The forcer housing may cause damage to parts through its movement at the end position of the machine.

- The operator should provide protective equipment to prevent from reaching into the danger area of the machine!

WARNING

Risk of burns!

The motor heats up during operation and thus touching the motor can lead to burns!

- After disconnecting the drive amplifier from the power supply, wait at least 5 minutes before removing the cover and touching the motor.

WARNING

Unauthorized repairs on the system

- Unauthorized work on the system creates the risk of injuries and may invalidate the warranty.
- The system must only be serviced by specialist personnel!

1.5 Copyright

Note:
HIWIN MIKROSYSTEM reserves the right to change the contents of this manual or product specifications without prior notice.

1.6 Manufacturer information

Table 1.6.1 Manufacturer's details

Corp.	HIWIN MIKROSYSTEM CORP.
Address	No.6, Jingke Central Rd., Taichung Precision Machinery Park, Taichung 40852, Taiwan
Tel.	+886-4-23550110
Fax	+886-4-23550123
Sales E-mail	business@hiwinmikro.tw
Customer Service E-mail	service@hiwinmikro.tw
Website	http://www.hiwinmikro.tw

1.7 Product monitoring

Please inform HIWIN MIKROSYSTEM, the manufacturer of the NPS, of:

- Accidents.
- Potential sources of danger in the NPS.
- Anything in this user manual which is difficult to understand.

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2. Basic safety information

2.1 Overview

The NPS stage is divided into NPS-LM and NPS-AC two series. NPS-LM series are driven by direct drive linear motor, and NPS-AC series are driven by AC servo motor and lead screw. Both NPS-LM and NPS-AC series incorporate linear cross-roller bearing, it allow NPS stage to provide high positioning accuracy, low angular and straightness error. The linear cross-roller bearing also provie high stiffness and smoothness motion, helps to achieve minimal incremental motion and high velocity stability.

2.2 Basic safety notices

The specified NPS may not be used outdoors or in hazardous areas where there is a risk of explosions. All NPS may only be used for the stated intended purpose.

- The NPS must be operated within its specified performance limits (see technical information and the approval drawing).
- Reading through the user manual and compliance with the maintenance and repair regulations are necessary for the intended use of the NPS.
- Any other use of the NPS shall be considered as contrary to the intended use.
- Use only original spare parts from HIWIN MIKROSYSTEM.

2.3 Reasonably foreseeable misuse

The NPS must not be operated:

- Outdoors
- In potentially explosive atmospheres

2.4 wConversions and modifications

Modifications of the NPS are not permitted! Please contact HIWIN MIKROSYSTEM for special request.

2.5 Residual risks

Normal operation of the NPS constitutes no residual risks.
Warnings about risks that may arise during maintenance and repair work are provided in the relevant sections.

2.6 Personnel requirements

wand regulations before starting work (See table 2.6.1).

Table 2.6.1 Personnel requirements

Activity	Qualification
Normal operation	Trained personnel
Cleaning	Trained personnel
Maintenance	Trained specialist personnel of the operator or manufacturer
Repairs	Trained specialist personnel of the operator or manufacturer

2.7 Protective equipment

2.7.1 Personal protective equipment

⚠CAUTION

Risk of noise.

The information below will enable the user of the machine to make a better evaluation of the hazard and risk.

- Equivalent A-weighted Sound pressure level according to EN ISO 3746: 70.5 dB (A)
- Uncertainty, K in decibels: 4.0 dB (A) according to EN ISO 4871

The emission levels are not necessarily safe working levels. While there is a correlation between the emission and exposure levels, this cannot be used reliably to determine whether or not further precautions are required.

Factors that influence the actual level of exposure of the workforce include the characteristics of the work room, the other sources of noise, the number of machines, other adjacent processes, and the length of time for which an operator is exposed to the noise. Also, the permissible exposure level can vary from country to country.

Table 2.7.1.1 Personnel requirements

Operating phase	Personal protective equipment
Normal operation	When carrying out normal operation, cleaning, maintenance and repairs, the following personal protective equipment is required: ■ Safety shoes ■ Protective helmet ■ Protective gloves
Cleaning	
Maintenance	
Repairs	

2.7.2 Protective equipment on the NPS

- NPS are fitted with position dampers.
- After every maintenance and repairs, these position dampers must be tested at the end positions and, if necessary, replaced.
- The machine may not be operated without position dampers or when dampers are damaged!

2.8 Labels on NPS

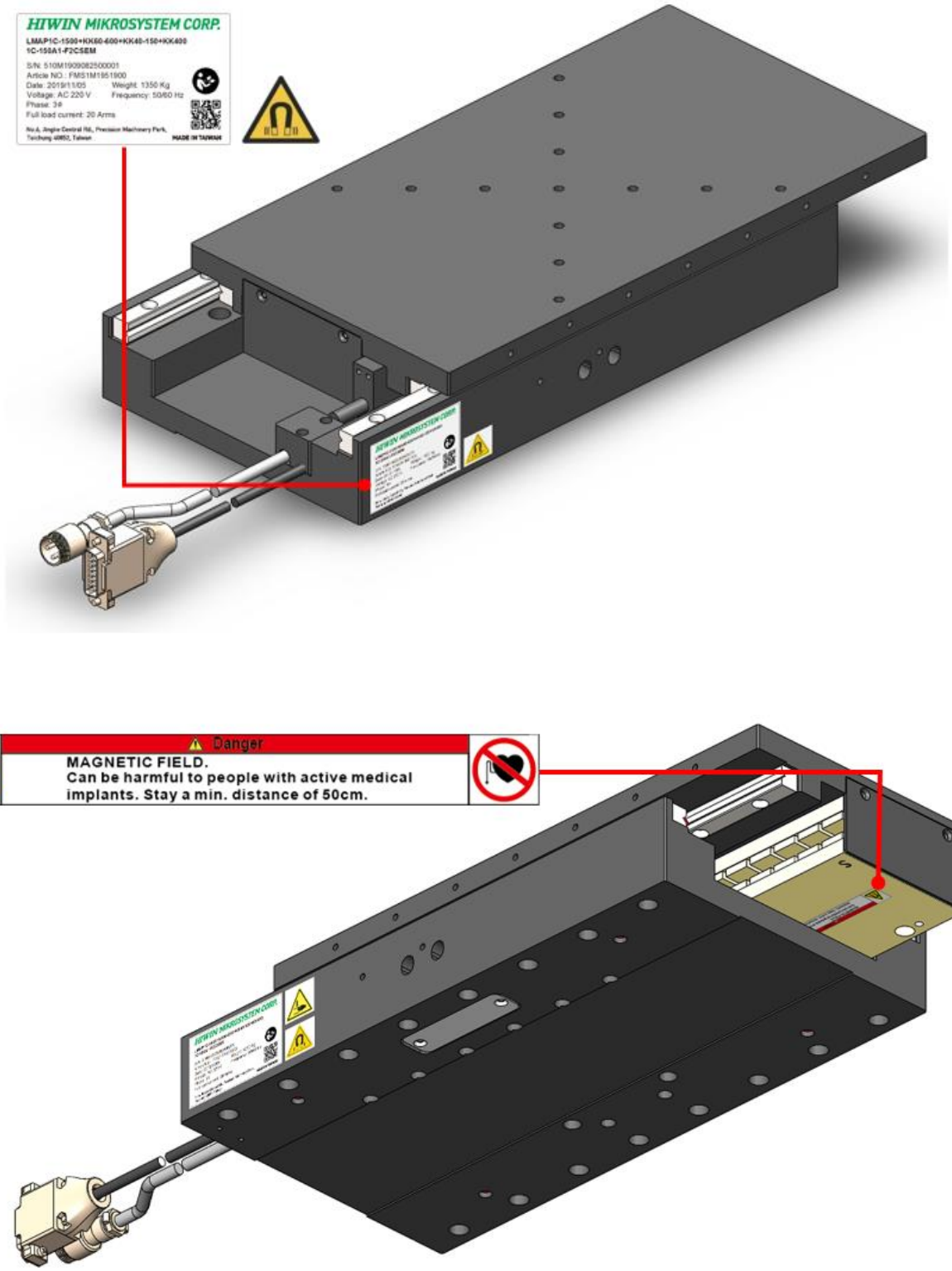

Figure 2.8.1 Warning labels of NPS-LM

Table 2.8.1 Warning symbols

Pictogram	Type and source of danger	Protective measures
	Danger from movements!	Keep out of the machine's area of movements! Prevent unauthorized access to the danger area!
	Danger from strong magnetic fields!	Do not bring watches or magnetizable data storage media close to (<500 mm) the NPS!
	Danger from strong magnetic fields!	Anyone with implants that are affected by magnetic fields should maintain a safe distance of at least 500 mm from NPS.

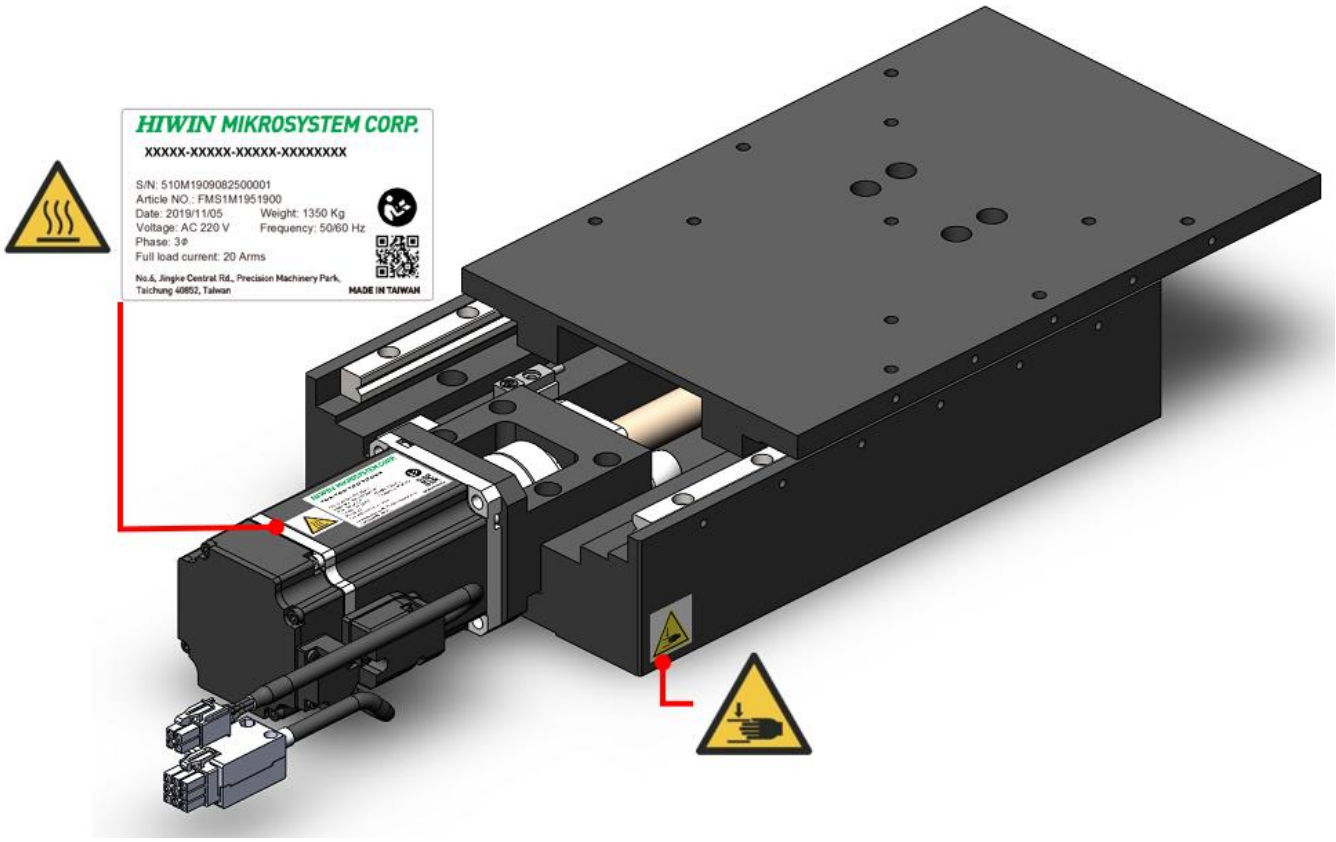

Figure 2.8.2 Warning labels of NPS-AC

Table 2.8.2 Warning symbols of NPS-AC

Pictogram	Type and source of danger	Protective measures
	Danger from movements!	Keep out of the machine's area of movements! Prevent unauthorized access to the danger area!
	Danger from high temperature!	Do not touch the motor surface during operation.

3. Product description

3.1 NPS description

NPS employ a non-recirculation cross-roller bearing, with the high stiffness, low starting friciton linear bearing, NPS could provide high rigidity and smooth motion than recirculation ball bearing.

Figure 3.1.1 shows the family of NPS. HUB and CB series are driven by a non-contact direct drive linear motor, that can helps to achieve very small incremental motion. AC series are driven by an AC servo motor.

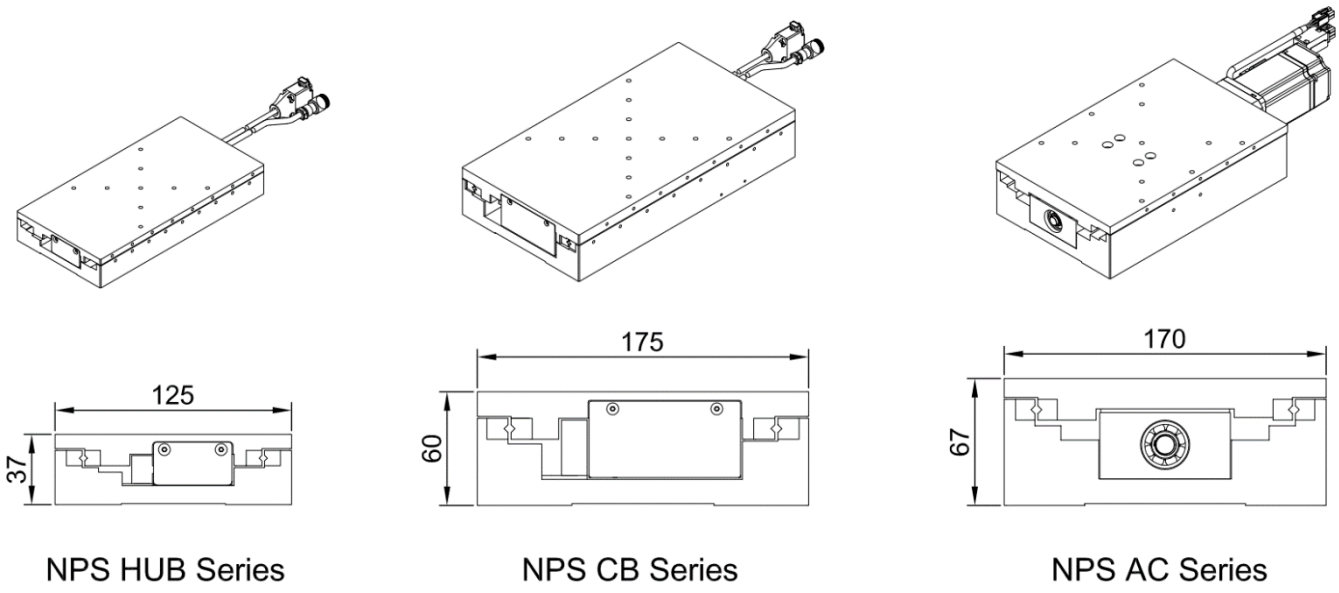

Figure 3.1.1 Series of NPS

Note:
HIWIN MIKROSYSTEM continually improves its product offerings, and listed options may be replaced at any time. Please refer to the most recent edition HIWIN MIKROSYSTEM of the product guide for the latest product information at https://www.hiwinmikro.tw/en.

3.2 Main components of NPS

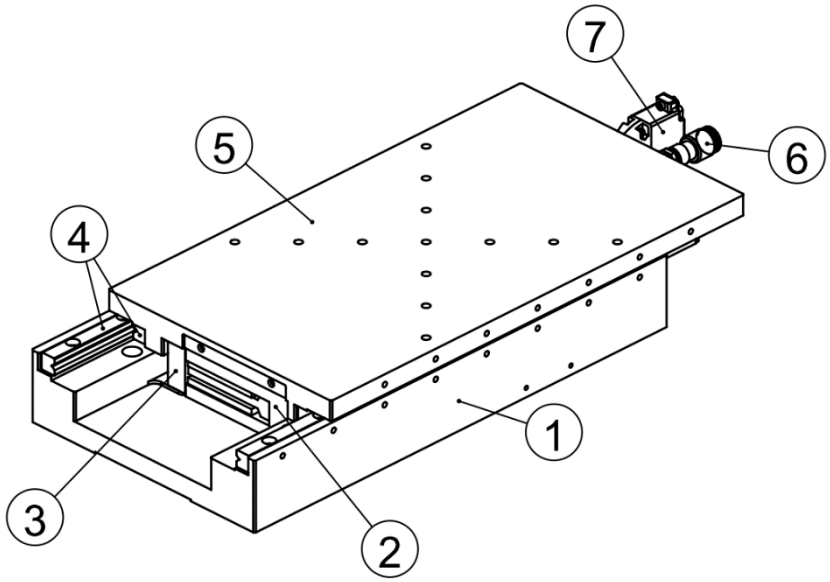

Figure 3.2.1 Main components of linear motor series NPS

Table 3.2.1 Main components of linear motor series NPS

Pos.	Components
1	Base
2	Moving magnetic stator
3	Coreless linear motor
4	Linear cross-roller bearing
5	Moving slide
6	Motor power cable
7	Linear encoder cable

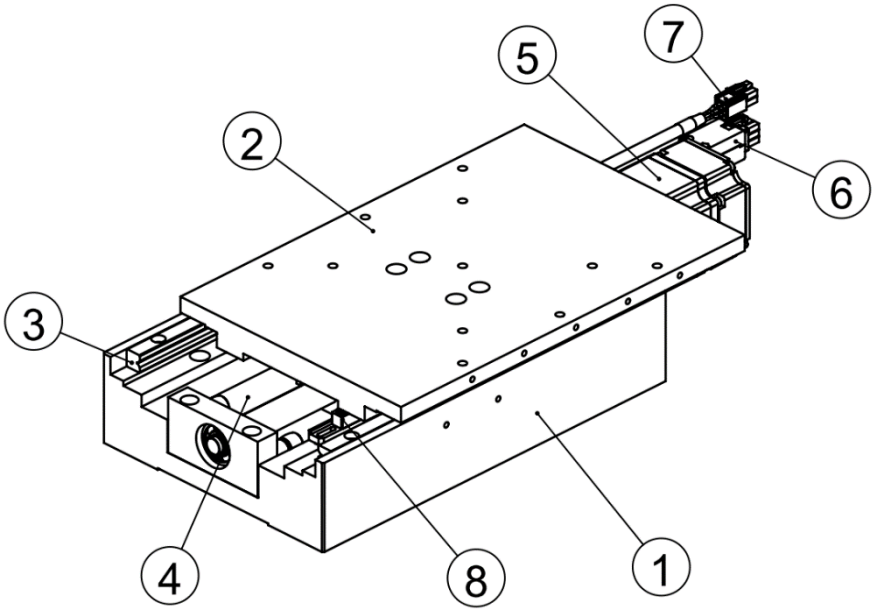

Figure 3.2.2 Main components of AC servo motor series NPS

Table 3.2.2 Main components of AC servo motor series NPS

Pos.	Components
1	Base
2	Moving slide
3	Linear cross-roller bearing
4	Ball screw
5	AC servo motor
6	Motor power cable
7	Rotary encoder cable
8	Limit switches

3.2.1 Linear motor / AC servo motors

A linear motor consists of two components, the forcer (primary part) with coils and the stator (secondary part) with permanent magnets. The coils carrying alternating current generate a magnetic field that changes over time and interacts with the steady magnetic field of the stator. The resulting force is used to generate linear motion. The linear motor components are supplied as separate parts.

Table 3.2.1.1 Linear motor specification (for UB1 / UB2 / CB4 / CB6 / CB8)

	Symbol	Unit	LMC-HUB1	LMC-HUB2	LMCB4	LMCB6	LMCB8
Continuous force	F_c	N	20	40	73	109	145
Continuous current	I_c	A_{rms}	1.5	3.1	2	2	2
Peak force(1s)	F_p	N	80	160	292	436	580
Peak current(1s)	I_p	A_{rms}	6.2	13	8	8	8
Pole pair pitch	2τ	mm	24	24	32	32	32
Resistance	R_{25}	Ω	7.5	3.8	7.1	10.7	14.6
Inductance	L	mH	1.4	0.7	2.6	3.8	5
Thermal switch	-	-	3 PTC SNM 120 In Series		3 PTC SNM100 In Series		
Maximum DC Bus voltage	-	V_{DC}	330				

An AC servo motor is a rotational or translational motor to which power is supplied by a servo amplifier. This motor is consists of closed-loop control system which considers the current output and alters it to the desired condition. The control action in these systems is based on the output of the motor and uses a positive feedback system to control the motion and final position of the shaft. The AC servo motor components are supplied as separate parts.

Table 3.2.1.2 AC Servo motors specification

	Symbol	Unit	200W	400W
Rated voltage	V	V_{AC}	220	
Rated power	W	W	200	400
Rated torque	T_c	N.m	0.64	1.27
Rated current	I_c	A_{rms}	1.6	2.5
Peak torque	T_p	N.m	2.24	4.44
Peak current(1s)	I_p	A_{rms}	6.4	10
Rated speed	ω_c	rpm	3000	3000
Resistance	R	Ω	5.53	3.59
Inductance	L	mH	8.76	7.22

3.2.2 Positioning measurement system

⚠CAUTION

Damage caused by scratching!

The measuring scale of the optical measuring system may be damaged by improper handling.

- ◆ Handle the measuring scale with care!

The distance travelled is measured by a high-resolution positioning measurement system that is mounted on the base. Depending on its type, the NPS features an optical or a magnetic positioning measurement system. The installed positioning measurement system is fully cabled and is connected to the controller via a separate connector (see technical Information and approval drawing).

Table 3.2.2.1 Positioning measurement system selection

Order code	Power supply		Resolution [µm]	Interface	
A	5V (±10%)	<150mA (fully terminated)	0.1 (default interpolation)	Incremental	1 Vpp (analog)
B	5V (±10%)	<150mA (fully terminated)	0.1 (default interpolation)	Incremental	1 Vpp (analog)
C	5V (-5% / +10%)	200mA (fully terminated)	0.1	Digital	TTL (digital)
D	5V (-5% / +10%)	200mA (fully terminated)	0.1	Digital	TTL (digital)

3.2.3 Limit switches

Depending on the type, a few optical or inductive switches generate a signal to the controller upon reaching the end of the travel distance. The limit switches are supplied pre-wired and operational.

3.3 Order code

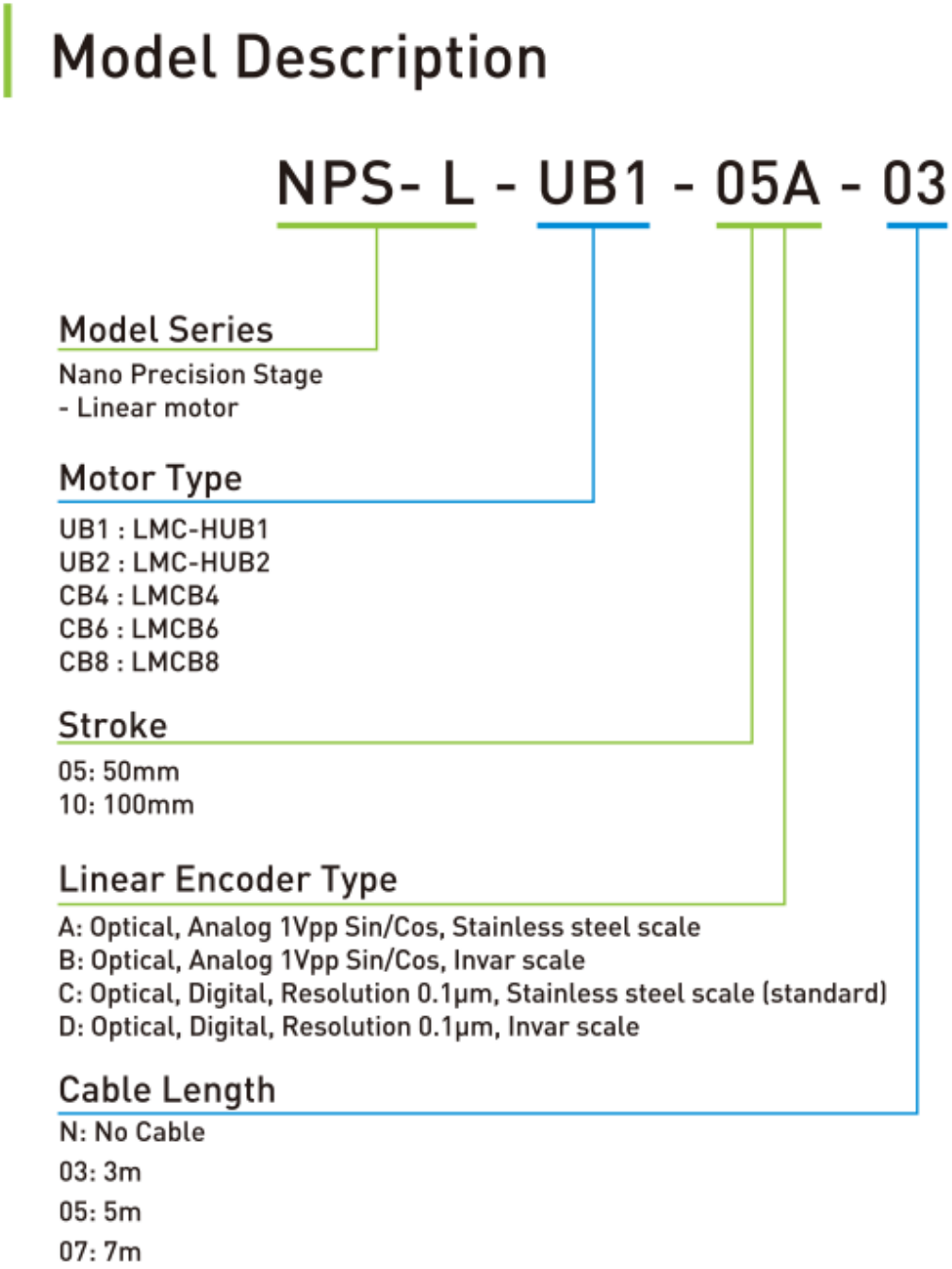

Figure 3.3.1 Order code for linear motor series NPS

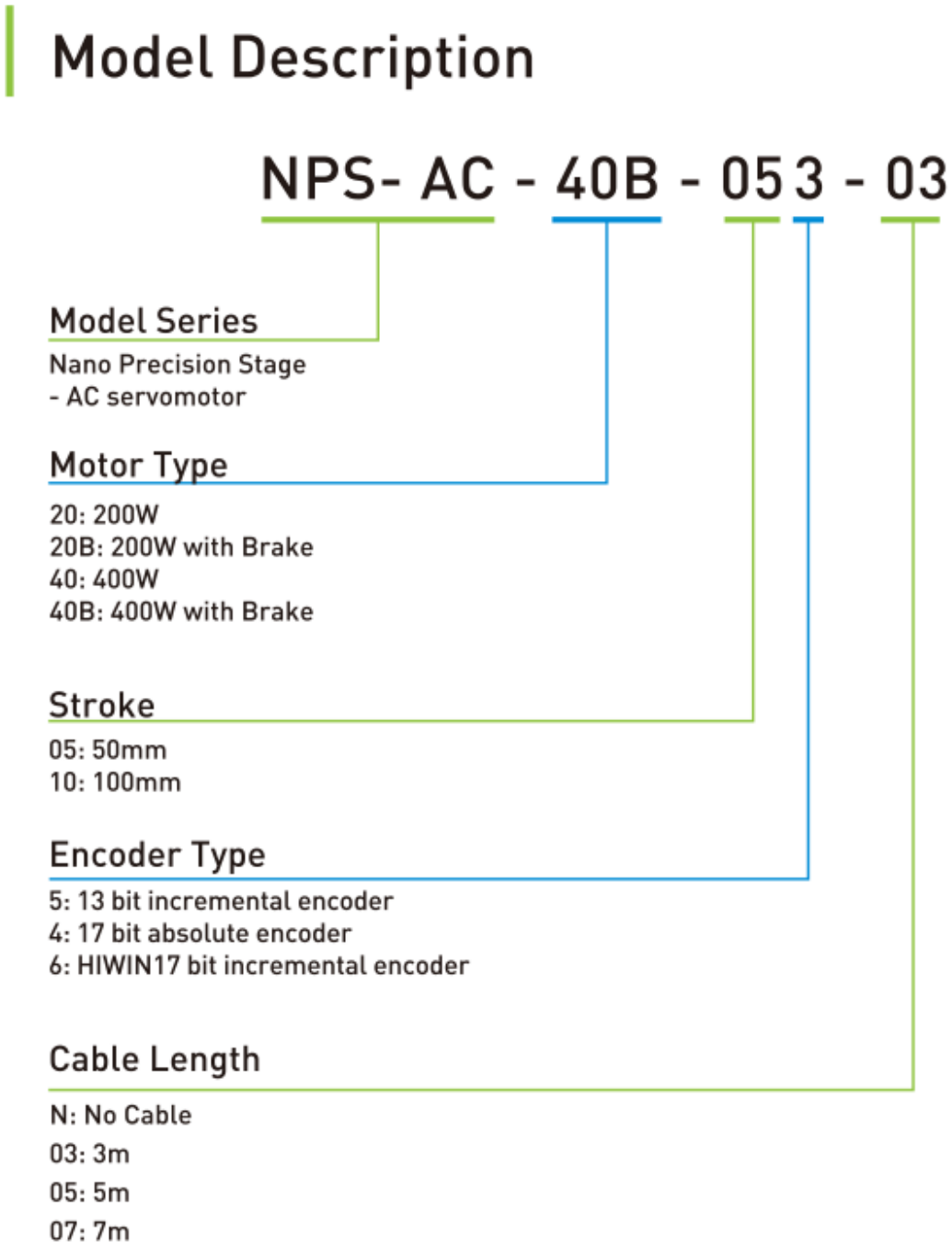

Figure 3.3.2 Order code for AC servo motor series NPS

Note:

HIWIN MIKROSYSTEM continually improves its product offerings, and listed options may be replaced at any time. Please refer to the most recent edition of the product guide for the latest product information at https://www.hiwinmikro.tw/en.

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4. Transport and setup

4.1 Delivery

The NPS are supplied fully assembled, function tested and ready for connection. To prevent damage arising during transport, the NPS are provided with transportation safety devices and shipping devices.

4.2 Transport to the installation site

DANGER

Danger from strong magnetic fields!

Strong magnetic fields around NPS pose a health risk to people with implants (e.g., cardiac pacemakers) that are affected by magnetic fields.

- Anyone with implants that are affected by magnetic fields should maintain a safe distance of at least 500 mm from NPS.

WARNING

Risk of crushing from forcer housing!

Danger of injury from crushing and damage to the NPS caused by movement of the forcer housing due to gravity, as it does not feature brakes in its standard version.

- Ensure that each transportation safety devices are well fixed before transportation. In most cases, the devices are made in red.

WARNING

Danger from heavy loads!

- Lifting heavy loads may damage your health.
- For system's weight over 20 kg, use a hoist of an appropriate size when positioning heavy loads!
- Check applicable occupational health and safety regulations when handling suspended loads!

⚠CAUTION

Risk of physical damage to watches and magnetic storage media.

Strong magnetic forces may destroy watches and magnetizable data storage media near to the NPS!

- Do not bring watches or magnetizable data storage media into the vicinity (<500 mm) of the NPS!

⚠CAUTION

Damage of the NPS!

The NPS may be damaged by mechanical loading.

- Ensure that the NPS does not bend as this could permanently damage accuracy.
- During transport, do not transport any additional loads on the NPS!
- Secure the NPS and components against tilting!

Note:

Electrical equipment is designed to withstand to protect against the effects of transportation, and storage temperature within a range of -25°C to +55°C and for short periods not exceeding 24 hours at up to +70°C.

■ Steps to transport the NPS:

(1). Disconnect power supply.

(2). Disconnect stage cables.

(3). Remove the payload.

(4). Secure the shipping bracket.

4.3 Requirements at the installation site

4.3.1 Ambient conditions

Table 4.3.1.1 Ambient condition requirement

Area of use	For indoor use only
Temperature	0 °C to 50 °C
Humidity	< 80%RH (non-condensing)
Altitude	< 1000m
Installation site	Flat, dry, vibration-free
Protection class	No interference from corrosive solvent or strong magnetic
Grounding	Plant power grounding line conforms to international requirements

Note:

(1). Avoid exposing to direct sunlight or heat rays.

(2). Away from electric magnetic interference source sites, such as welding, discharge machine.

4.3.2 Safety equipment to be provided by the operator

Possible safety equipment/measures:

- Personal protective equipment in accordance with regional regulations.
- Mechanical protective equipment.

4.4 Storage

DANGER

Danger from strong magnetic fields!

Strong magnetic fields around NPS pose a health risk to people with implants (e.g., cardiac pacemakers) that are affected by magnetic fields.

- Anyone with implants that are affected by magnetic fields should maintain a safe distance of at least 500mm from NPS.

Note:

(1). Store the NPS in its transport packaging.

(2). Only store the NPS in dry, frost-free areas with a corrosion-free atmosphere.

(3). Clean and protect used NPS before storage.

(4). When storing the NPS, attach signs warning of magnetic fields.

4.5 Unpacking and setup

CAUTION

Damage of attachments!

Attachments may be damaged by mechanical loading.

- Secure and move the NPS using the suspension points provided!

Note:

(1). The NPS may only be installed and operated indoors.

(2). The NPS-L is designed for horizontal installation. During installation, the angle cannot exceed 1° because it does not have a braking system.

■ Steps to unpack and install the NPS:

(1). Remove protective film.

(2). Carefully transport the NPS on the shipping devices provided to the specified installation site.

(3). Ensure that the maintenance points are easily accessible.

(4). Dispose of packaging in an environmentally friendly way.

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5. Assembly and connection

5.1 Mechanical installation

5.1.1 Mechanical mounting

CB and HUB series NPS are properly fixed with shipping brackets before shipment to prevent damage during shipment. Remove the shipping brackets before install the stage. Retain the shipping brackets for future shipping use.

Flatness of the mounting surface must be within 5μm to achieve high accuracy and make sure the stage could working properly.

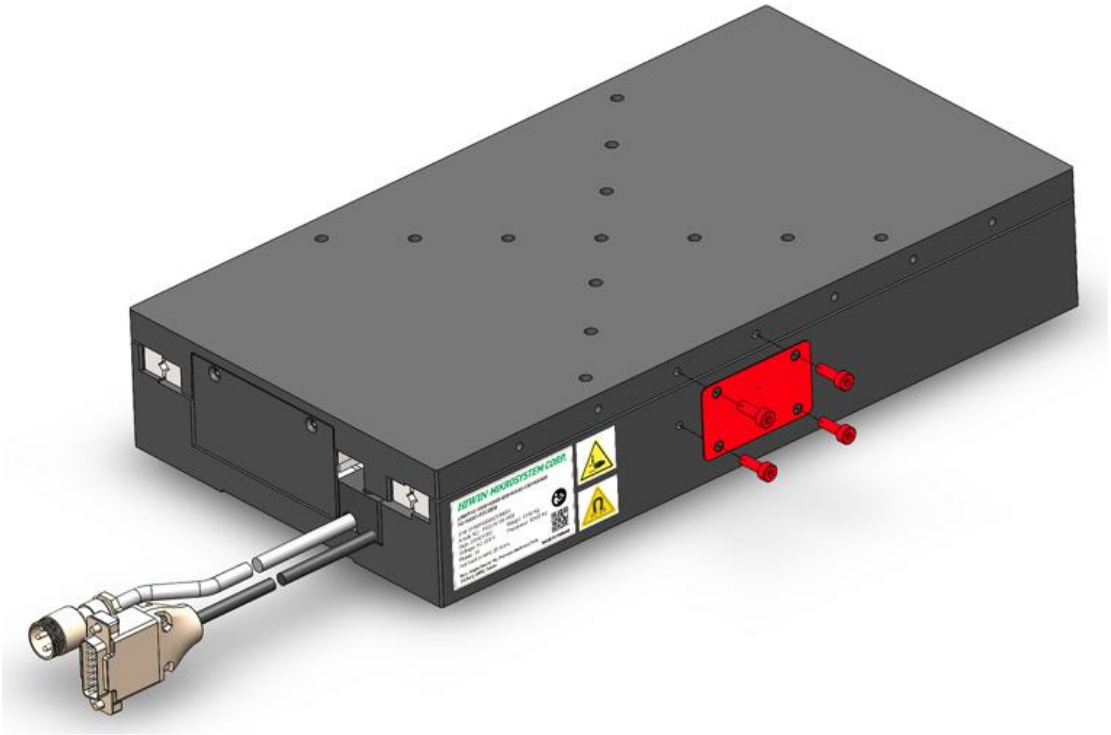


Figure 5.1.1.1 Shipping bracket of NPS

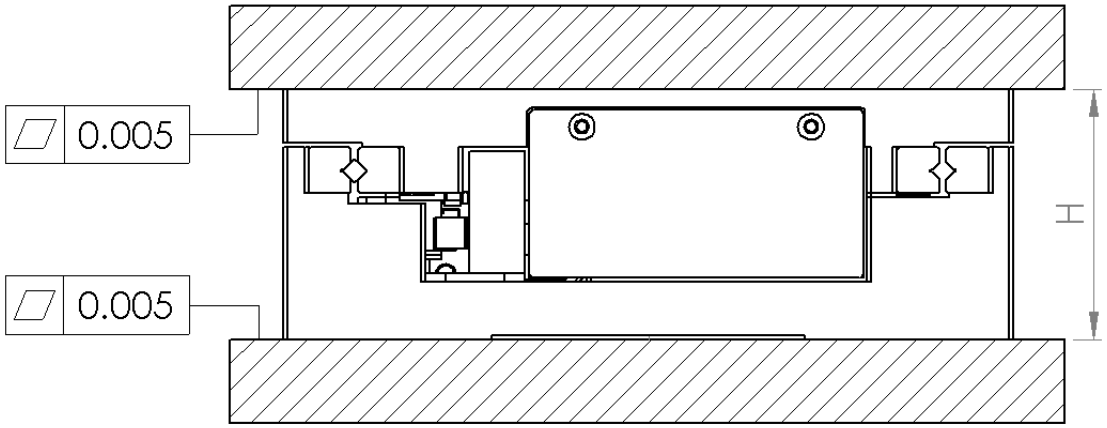


Figure 5.1.1.2 NPS assembly

Note:

(1). To maintain accuracy, the mounting surface should be flat.

(2). The stage base is precision machined and verified for flatness prior to stage assembly at the factory.

(3). The accuracy is measured on granite plane before shipment.

Table 5.1.1.1 NPS assembly dimensons (H)

Suitable for linear axis	Dimensions(mm)
LMC-HUB1	37
LMC-HUB2	37
LMCB4	60
LMCB6	60
LMCB8	60
NPS-AC-20	67
NPS-AC-40	67

5.1.2 Assembling the NPS

■ Steps to assemble the NPS:

(1). Flatness of the mounting surface must be within 5μm to achieve high accuracy and make sure the stage could working properly.

(2). Clean the mounting surface.

(3). Clean the mounting surface of stage base.

(4). Place the stage to the desired mounting position.

(5). Remove the shipping bracket.

(6). Move the slide to access the mounting holes.

(7). Tightening the bolt to the specific torque (See Table 5.1.2.1).

Note:
After assembling the moved load, please design another transportation safety device to lock the forcer.

Table 5.1.2.1 Mounting torque

Hex socket cap bolt Size	Torque (Nm)	Material	strength class
M4	3.9	Alloy steel	12.9
M5	8.8	Alloy steel	12.9
M6	13.2	Alloy steel	12.9
M8	32.3	Alloy steel	12.9

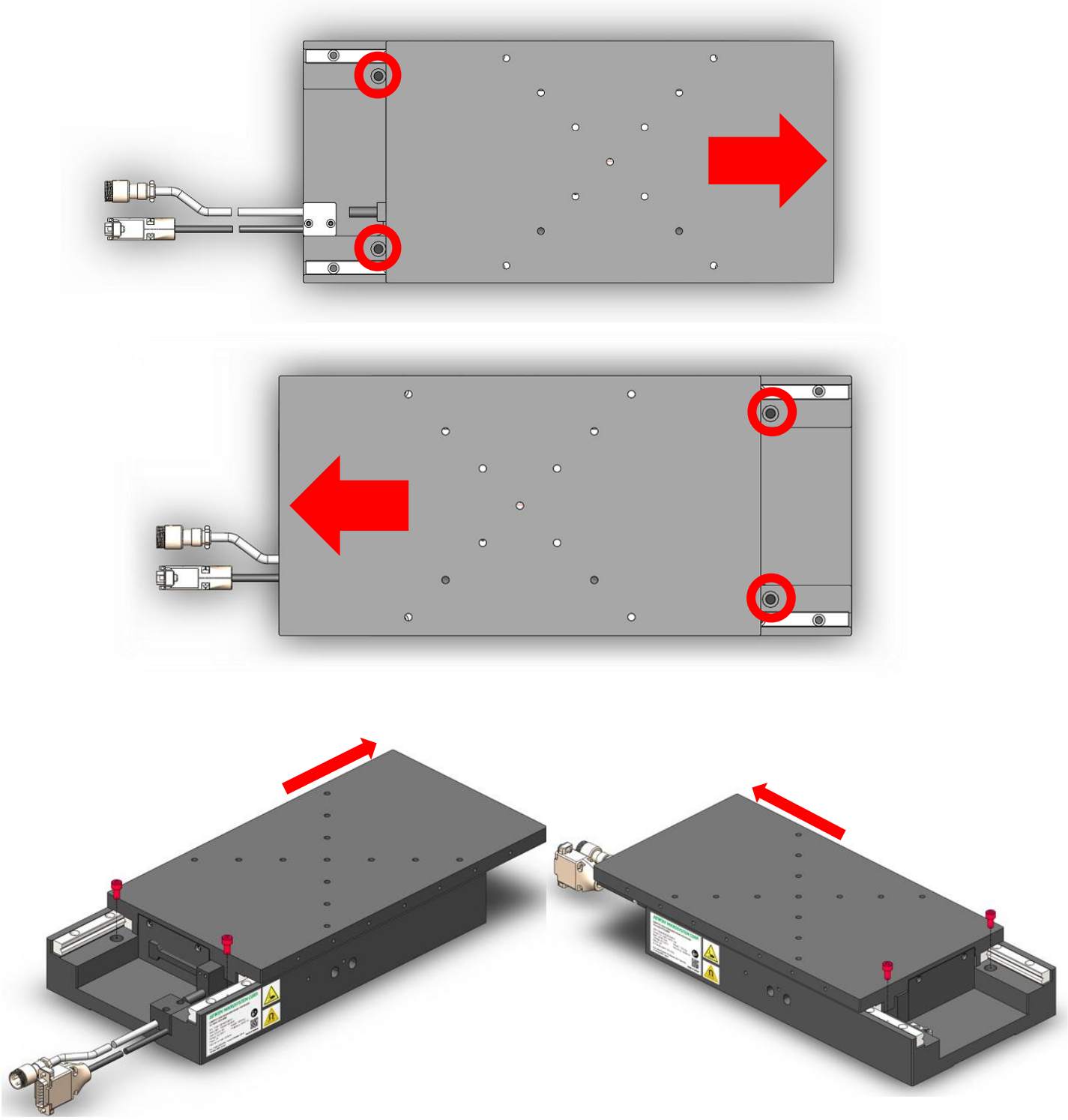


Figure 5.1.2.1 Assembling the NPS

5.1.3 Assembling the payload

■ Steps to assembling the payload:

(1). Flatness of the mounting surface of payload must be within 5μm to achieve high accuracy and make sure the stage could working perperly.

(2). Clean the mounting surface of the slide of NPS.

(3). Clean the mounting surface of the payload.

(4). Securing the payload with bolt to the specific torque (See Table 5.1.2.1).

5.2 Electrical installation

DANGER

Danger from electrical voltage!

If linear motors are incorrectly grounded, there is a danger of electric shock.

◆ Before connecting the electrical power supply, ensure that the NPS is correctly grounded.

DANGER

Danger from electrical voltage!

Electrical currents may flow even if the motor is not moving.

◆ Ensure that the NPS is disconnected from the power supply before the electrical connections are separated from the motors.

◆ After disconnecting the drive amplifier from the power supply, wait at least 5 minutes before touching live parts or breaking connections.

◆ For safety reasons, measure the voltage in the intermediate circuit and wait until it has fallen below 40V.

Note:

(1). Observe the separate assembly instructions of the drive!

(2). The supply voltage is based on the drive. Please consult the manufacturer's separate operating instructions for detailed information.

(3). Supplied with cabling ready for operation.

(4). All necessary connections via three connectors of each axis.

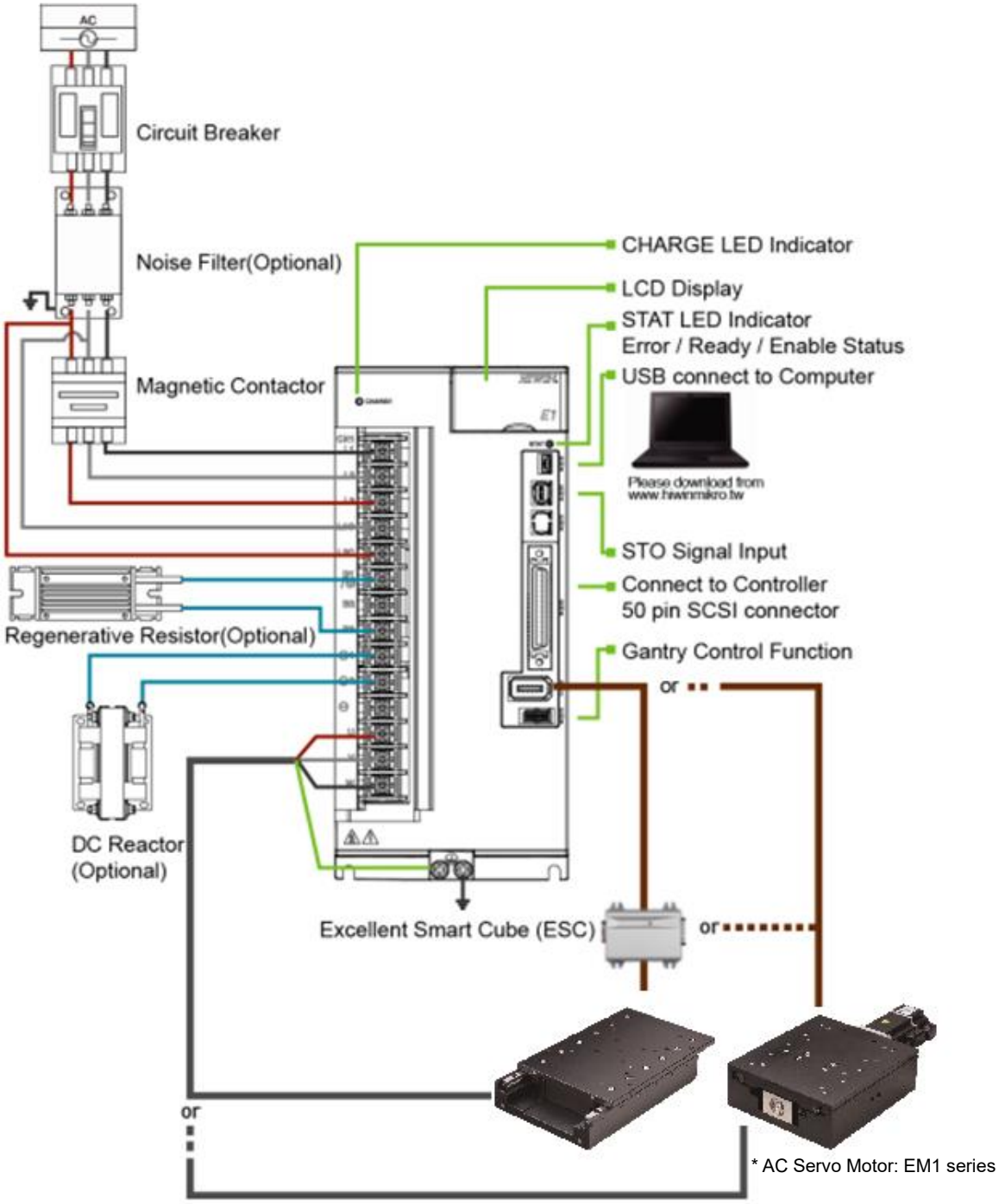


Figure 5.2.1 Electrical connection for E1 drive

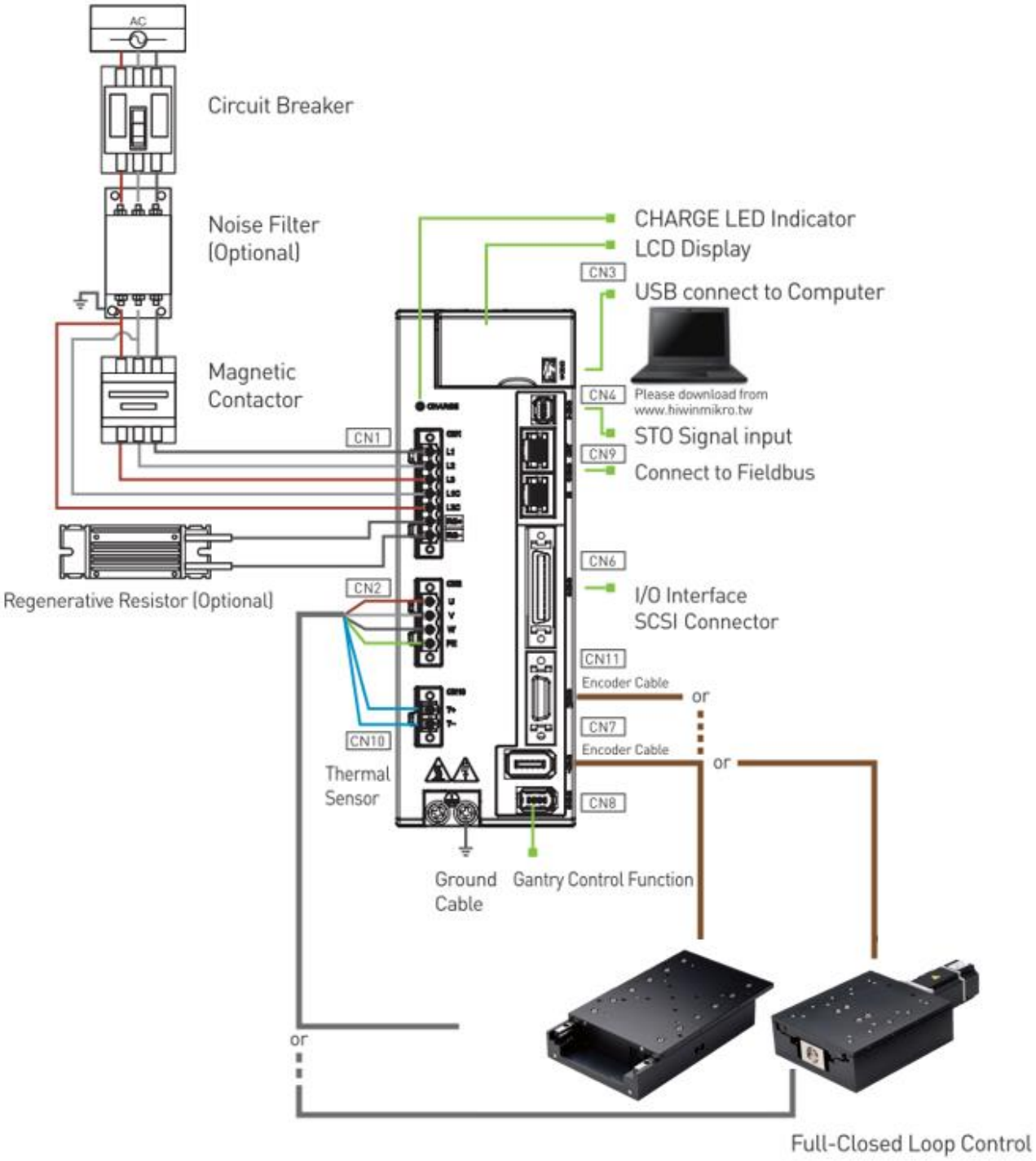


Figure 5.2.2 Electrical connection for E2 drive

5.2.1 Power supply and controller selection

The continuous current, peak current and bus voltage must be considered while selecting a power supply. In addition, the resonance effect which can be induced in motors by some drive systems must be taken into account. Motors are assembled with several individual coils connected in series. Each one of these coils has an inductance in series and a stray capacitance to the ground. The LC network obtained possesses a resonant frequency, so when an electrical oscillation is applied to the phase inputs (in particular the PWM frequency), the neutral point of the motor can oscillate with very high amplitudes with respect to the ground, and the insulation can be damaged as a consequence of these oscillations. This phenomenon is more obvious in motors with a large number of poles (such as Linear motors).

- When selecting power supply, please check the conditions below:
  330 V DC controller: 750 V_p (phase to ground), voltage gradient: 8 kV/μs.

The cable between the controller and the motor will generate a reflected wave due to the impedance mismatch between the cable and the motor, and the reflected voltage will be superimposed with the subsequent input voltage, causing the voltage to rise. This phenomenon will be more obvious when the motor cable is longer. If the length of the cable between the controller and the motor is longer than 10 m, it is necessary to measure voltages at the motor terminals to ensure they are lower than specified above. If the measured value is greater, a dV / dt filter must be inserted between the controller and the motor for protection.

Note:
For the maximum motor operation voltage, please refer to “Linear Motor Technical Information”, which can be downloaded from the official website.

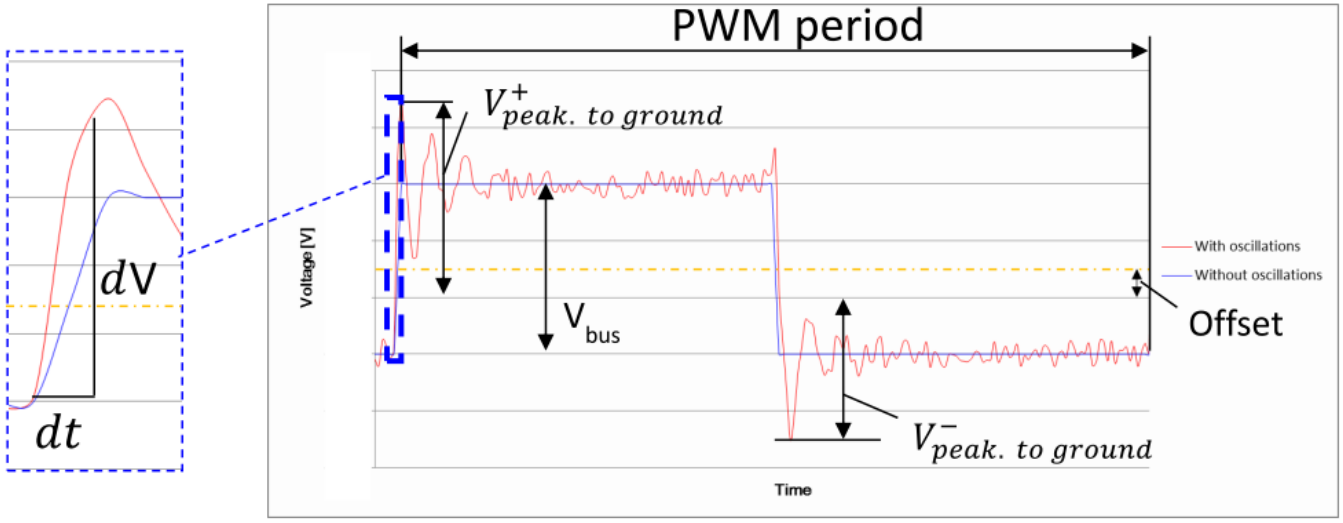


Figure 5.2.1.1 Voltage schematic

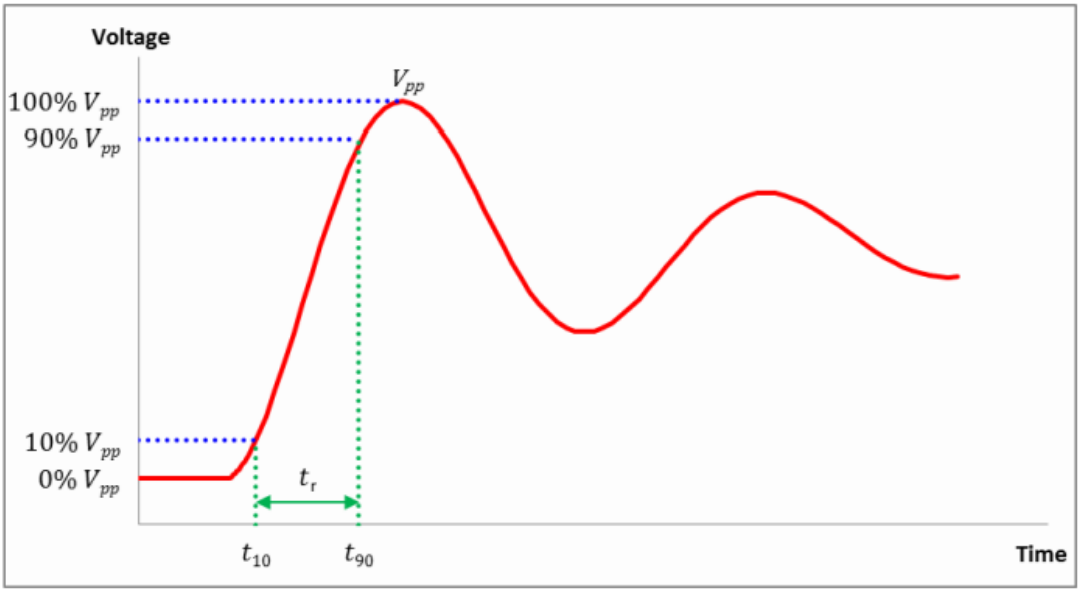


Figure 5.2.1.2 Rising time t_r definition

Table 5.2.1.1 Voltage limitation of power supply and neutral point

Item	Mounting
V_{bus}	Max. 330
$\left\|V^{+}_{peak.\ to\ ground}\right\|$	<750 V_p (phase to ground) @ PWM frequency
$\left\|V^{-}_{peak.\ to\ ground}\right\|$	<750 V_p (phase to ground) @ PWM frequency
Voltage gradient $\|dV/dt\|$	< 8 $Kv/\mu s$ If it is difficult to obtain instantaneous voltage gradient, the following formula can be used to estimate (Figure 5.2.1.2)： $\|dV/dt\| = \left\|\left(90\%V_{pp} - 10\%V_{pp}\right)/t_r\right\|$

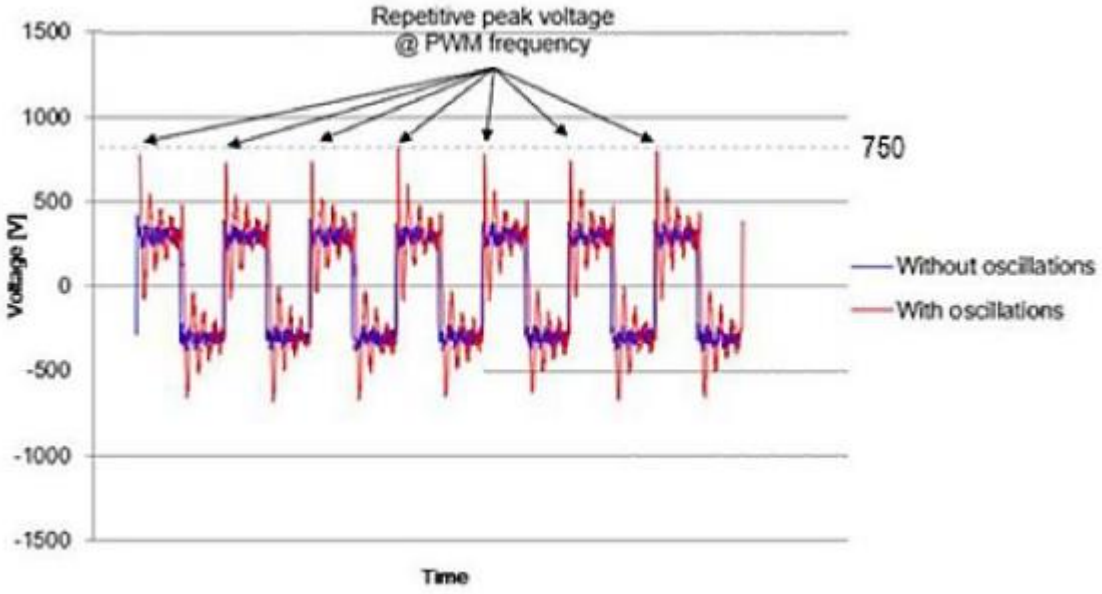


Figure 5.2.1.3 Voltage oscillation schematic (300 V_DC controller)

5.2.2 Connecting ironless motors/AC servo motors

The temperature sensor system cable is routed as standard through the motor's extension cable. Both cables are therefore connected to the motor plug.

Note: Check the technical information and approval drawing for pin assignment!

5.2.3 Connecting the linear positioning measurement system

⚠CAUTION

Danger of EMC interference in the encoder signal!

- Approved ESD precautions must be followed at all times during read head and interface electrical connections.
- Make sure that the encoder cable has been shielded correctly!
- Ensure that the shielding is in full contact across the connectors!
- Ensure that the pairs of wires with the sin/cos signal are shielded separately!

⚠CAUTION

Danger of injury!

- An incorrectly connected distance measuring system may cause uncontrolled carriage movements which can lead to injuries or might damage the linear axis.
- Only qualified personnel may connect the distance measuring system!

Note:

(1). The linear positioning measurement system is installed ready for operation in the NPS.

(2). Check the technical information and approval drawing for pin assignment!

Table 5.2.3.1 Linear motor power connector

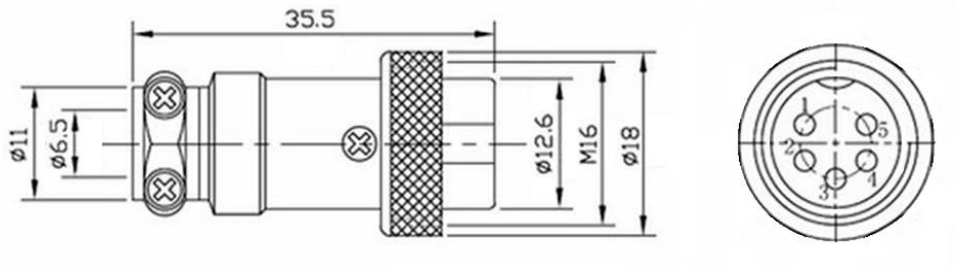
Type	Pole configuration
GX16 5P (Male)	

Table 5.2.3.2 Linear motor pin assignment

Pin no.	Signal
1	V
2	U
3	W
4	T+
5	T-
Housing	Ground

Table 5.2.3.3 Linear encorder connector

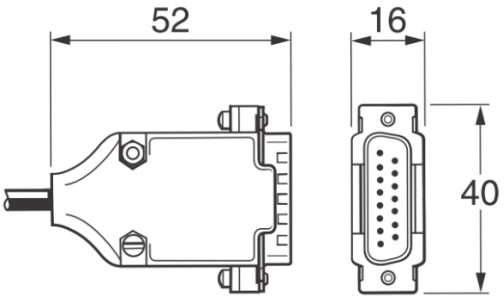
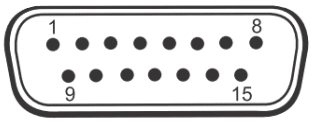
Type	Pole configuration	
D-Sub 15-pin (Male)		

Table 5.2.3.4 Linear encorder pin assignment

Pin no.	D-Sub 15-pin	
	Analog 1 Vpp, Peroid 20μm (Encoder code A, B)	Digital 0.1μm resolution (Encoder code C, D)
1	Cos-	-
2	Sin-	0V
3	Z+	-
4	5V	Z-
5	5V	B-
6	-	A-
7	+ Limit output	5V
8	- Limit output	5V
9	Cos+	0V
10	Sin+	- Limit output
11	Z-	+ Limit output
12	0V	Z+
13	0V	B+
14	-	A+
15	-	-
Housing	Shielding	Shielding

Table 5.2.3.5 Linear encoder parameter

Encoder code A, B: Optical analog encoder	
Linear scale grating period	20 μm
Signal	Analog,1 Vpp sin/cos
Encoder code C, D: Optical digital encoder	
Resolution	0.1 μm
Signal	digital, TTL 5V

Table 5.2.3.6 AC servo motor power connector

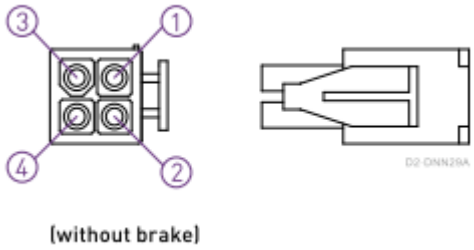
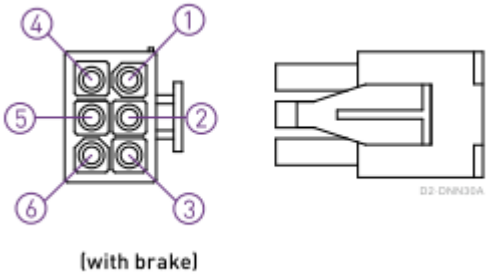
Type	Pole configuration
Without brake	
With brake	

Table 5.2.3.7 AC servo motor pin assignment

Pin no.	Signal	
	Without brake	With brake
1	W	W
2	V	V
3	U	U
4	GND	GND
5	-	B+
6	-	B-

Table 5.2.3.8 Rotary encoder connector

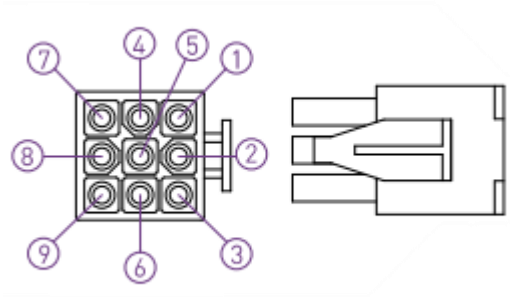
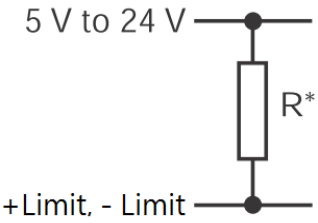
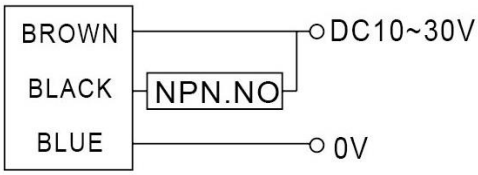
Type	Pole configuration
Pluggable PCB Connectors (9-pin)	

Table 5.2.3.9 Rotary encoder pin assignment

Pin no.	Signal	
	HIWIN 17bit Incremental	17bit absolute
1	5V±5%	5V±5%
2	0V	0V
3	SL+	-
4	SL-	-
5	-	VB
6	-	GND
7	MA+	SD+
8	MA-	SD-
9	Shielding	Shielding

5.2.4 Connecting the limit switch

The inductive proximity switches in design as limit switches are installed ready for operation in NPS-AC series. For NPS-L series, two built-in magnetic switches are used as limit switches.

Stage series	NPS-L-CBX NPS-L-UBX	NPS-AC
Type	Optical encoder built-in limit switch	Inductive proximity switch
Output	Open collector	NPN, Normal open
Wiring	 Select R to limit the maximum current does not exceed 10mA. Alternatively, use a suitable relay.	

Note:

(1). Check the technical information and approval drawing for the position of limit switches.

(2). Check the technical information and approval drawing for limit switch pin assignment.

6. Commissioning

6.1 Commissioning

6.1.1 Switch on the NPS

DANGER

Danger from strong magnetic fields!

Strong magnetic fields around NPS pose a health risk to people with implants (e.g., cardiac pacemakers) that are affected by magnetic fields.

- Anyone with implants that are affected by magnetic fields should maintain a safe distance of at least 500 mm from NPS.

WARNING

Risk of crushing from strong forces of attraction!

Strong magnetic forces may attract steel or iron objects from the NPS and cause crushing!

- No heavy (> 1 kg) or large (> 0.01 m^2) steel or iron objects should be held by hand into the immediate surrounding area (50 mm) of the magnet track!
- Use suitable tools only.

WARNING

Risk of crushing from moving forcer housing!

The forcer housing may cause damage to parts through its movement at the end position of the machine.

- The operator should provide protective equipment to prevent from reaching into the danger area of the machine!

WARNING

Risk of burns!

The motor heats up during operation so touching the motor can lead to burns!

- Provide protective devices and warning notices at the motor!

⚠CAUTION

Risk of physical damage to watches and magnetic storage media.

Strong magnetic forces may destroy watches and magnetizable data storage media near to the NPS!

- Do not bring watches or magnetizable data storage media into close to (<500 mm) the NPS!

⚠CAUTION

Damage of the NPS!

Danger of material damage through uncontrolled movements of the forcer housing in the case of a power cut!

- Ensure that the dampers are fitted in the end positions on both sides of the NPS!
- No heavy load on the cover!
- No moving the forcer housing!

Note:

The operator should provide a controller according to EN ISO 12100 that prevents the machine from being started up unintentionally after power is restored, troubleshooting or the machine is stopped.

■ Steps to switch on the NPS:

(1). Switch off the controller.

(2). Pull out the motor cable.

(3). Connect positioning measurement system cable.

(4). Switch on the controller.

(5). Check the positioning measurement system (see separate assembly instructions for the drive and positioning measurement system).

(6). Switch off the controller.

(7). Connect the motor cable.

(8). Switch on the controller.

(9). Perform test run at slow speed.

(10). Perform test under usage conditions.

6.1.2 Programming

The programming of the NPS depends on the controller and drive used. Check the user manual for the controller and drive!

7. Maintenance and cleaning

7.1 Maintenance

DANGER

Danger from electrical voltage!

Before and during maintenance and cleaning, dangerous currents may flow.

- Work may only be carried out by a qualified electrician and with the power supply disconnected!
- Before carrying out work on the NPS, disconnect the power supply and protect it from being switched back on!

DANGER

Danger from strong magnetic fields!

Strong magnetic fields around NPS poses a health risk to people with implants (e.g., cardiac pacemakers) that are affected by magnetic fields.

- Anyone with implants that are affected by magnetic fields should maintain a safe distance of at least 500 mm from NPS.

WARNING

Risk of crushing from moving parts!

The forcer housing may cause damage to parts through its movement at the end position of the machine.

- The operator should provide protective equipment to prevent from reaching into the danger area of the machine!

WARNING

Risk of burns!

The motor heats up during operation and thus touching the motor can lead to burns!

- After disconnecting the drive amplifier from the power supply, wait at least 5 minutes before removing the cover and touching the motor.

WARNING

Unauthorized repairs on the system

Unauthorized work on the system creates the risk of injuries and may invalidate the warranty.

- The system must only be serviced by specialist personnel!

⚠CAUTION

Risk of physical damage to watches and magnetic storage media.

Strong magnetic forces may destroy watches and magnetizable data storage media near to the NPS!

- ◆ Do not bring watches or magnetizable data storage media into close to (<500 mm) of NPS!

Note:

Use only suitable and non-hazardous agents. Please check the manufacturer's safety data sheets.

- HIWIN G04 grease are used for NPS lubrication, do not use other greases in case of incompatible.
- Drive the stage through whole stroke every week, to ensure the misaligned rollers of the linear guide caused by unexpect external force or fast movent could back to correct position. This could also redistribute the grease in the linear guide.

(1). Drive the slide to the one end of the stroke and disconnect the power of the stage.

(2). Cleaning the deteriorated grease and dust by wipes.

(3). Apply HIWIN G04 grease to the exposed linear guide.

(4). Drive the stage to opposite side and disconnect the power.

(5). Cleaning the linear guide and relubricate the guide.

(6). Drive the stage for full travel stroke 5 times.

(7). Wipe off excess grease.

■ During maintenance:

(1). Secure the NPS against being switched on without authorization.

(2). Disconnect the power supply of the NPS.

(3). Secure the NPS against being switched back on without authorization.

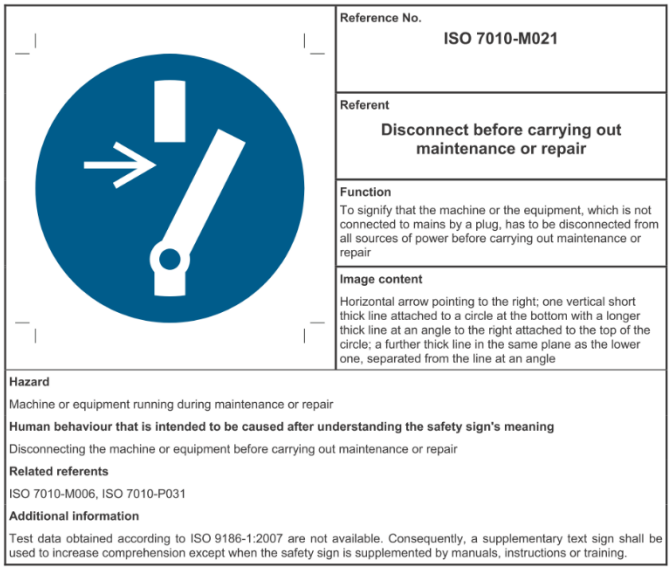


Figure 7.1.1 Example of a warning sign

7.1.1 Linear motor

- Ensure that no parts are located between the forcer and the magnet track!
- The linear motor operates maintenance-free.

7.1.2 Positioning measurement system

- Ensure that no extra particles caught between the encoder and the measuring scale! Only use soft cloth for cleaning to avoid scratching the measuring scale!

The optical positioning measurement system works on a non-contact basis and thus requires no maintenance. Regularly check the measuring scale for dirt and clean if necessary, as otherwise the surface of the measuring scale may become scratched and may no longer function correctly.

7.1.3 Electromechanical components

The cable have a limited lifetime. However, the lifetime cannot be calculated exactly due to ambient conditions and drive performance. The following components should therefore be regularly checked for wear and correct position, and should be replaced if necessary (wearing parts are not covered by the warranty):

- Cable (e.g. signs of abrasion on the cable insulation)
- Cable plug connections
- Distance between the limit switch shelter and sensors (common cause of malfunction of the limit/reference switch)

In critical production situations, make sure that there is a stock of wearing parts!

7.1.4 Linear cross-roller bearing

7.1.4.1 Lubrication

As with rolling bearings, the rails of NPS require a sufficient supply of lubricant. This lubrication reduces wear, protects against dirt and deposits, prevents corrosion and extends service life.

- Ensure that old grease, dirt and chippings are removed from the profile rails before lubrication.
- Use only HIWIN G04 grease to the lubricate the linear cross-roller bearing.
- Ensure that only lubricants without solid lubricant particles (e.g. graphite or MoS2) are used!
- For NPS-HUB/NPS-LMC, apply a thin, continuous flim of lubricant to the linear cross-roller bearing guides.
- For NPS-AC, apply a thin, continuous flim of lubricant to the linear cross-roller bearing guides and the ball-screw threads.

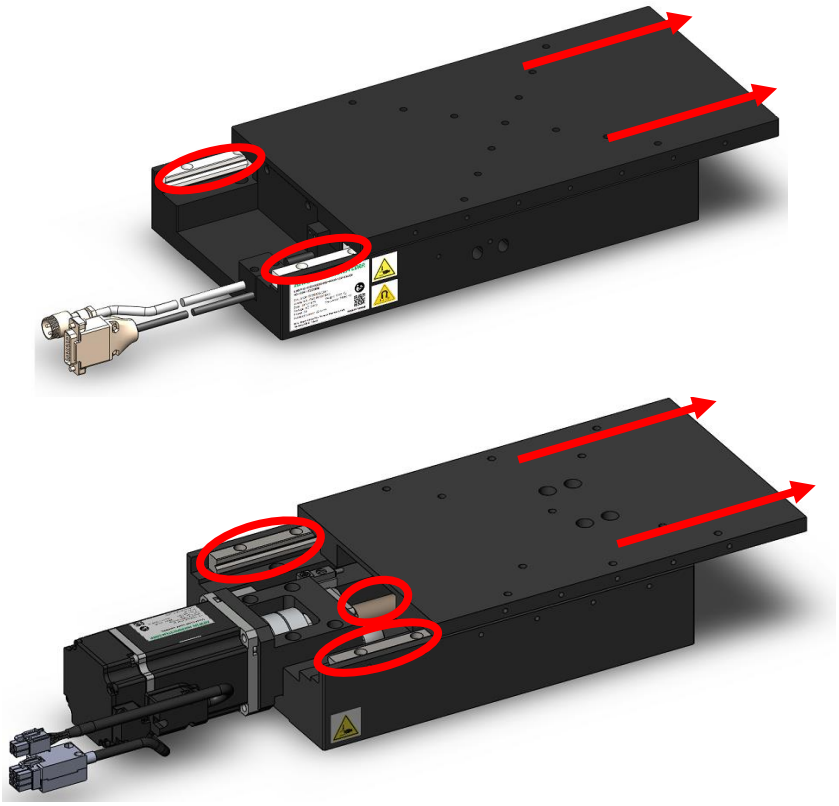


Figure 7.1.4.7.1.1. Location for lubrication

7.1.4.2 Relubrication intervals for grease lubrication

The recommended relubrication period is about 6 months or 500km of travel distance under normal conditions, For some applications that duty cycles > 50%, smaller lubrication period are required.

7.2 Cleaning

Dirt can settle and accumulate over time on unprotected profile rails. Profile rails must therefore be regularly checked for dirt and cleaned if necessary. Stage can start motion after cleaning the excessive grease:

- Clean the overflows on guideway and blocks
- Clean the optical encoder and scale
- Clean the stator.

Note:

(1). Please apply IPA on wiper for cleaning. Do not apply the IPA on the scale directly.
(2). Do not use Ethanol or any other solvent to clean up optical scale.
(3). Be care for the strong magnetic forces when cleaning.
(4). Coreless stator is not suitable on the following maintenance procedure. If the stator has been attracted with each other, please contact HIWIN MIKROSYSTEM's staff to assist it.
(5). If the stage is used under unideal environment, cleaning on stators should be performed regularly.
(6). Stators and forcers (iron materials) can make powerful suction, which would hurt fingers and palms seriously. Don't let magnetic items get too close to avoid magnet attract. (E.g., Knife, tools.)

7.2.1 Test run

After lubricating, please cycle run the stage for over 10 minutes before regular usage, which could evenly distribute the grease between the block and guideway. This could also release the saturation pressure and avoid the grease continuing to overflow and accumulating between the block and the guideway.

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8. Disposal

8.1 Waste disposal

⚠CAUTION

Danger caused by environmentally hazardous substances!

The danger to the environment depends on the type of substance used.

- Clean contaminated parts thoroughly before disposal!
- Clarify the requirements for safe disposal with disposal companies and, where appropriate, with the competent authorities!

Table 8.1.1 Disposal

Fluids	
Lubricants	dispose of as hazardous waste in an environmentally friendly way
Soiled cleaning cloths	dispose of as hazardous waste in an environmentally friendly way
Nano Precision Stage	
Cabling, electrical components	dispose of as electrical waste
PP components (e.g., cable chain)	dispose of separately
Steel components (e.g., guideways)	dispose of separately
Aluminum components (e.g., base)	dispose of separately

9. Troubleshooting

9.1 Troubleshooting

Table 9.1.1 Fault table

Symptom	Cause	Action
Motor does not start	Power supply cables disconnected	Check connections. Plug contacts may be compressed, repair if necessary. The connectors have seals, which means that a certain screw connection resistance must be overcome.
	Fuse has tripped via motor protection	Check motor protection for the right settings. Fix defects if necessary
Upon restart, the drive reports a fault during commutation	Encoder counting direction incorrect	Change the sin and cos pair of wires in the encoder plug
	Slide is too close to the limit switch/limit stop	Disconnect power supply and move slide manually into the center of the stage.
	Additional drive resistance	Change parameters in the drive amplifier
Axis overspeeds upon restart	Commutation incorrect	See fault during commutation
		Check commutation parameters in the drive, activate speed monitoring!
	EMC interference with the encoder signal	Check the shielding of the connectors and cables
Axis overspeeds in positioning mode	Programming error in the position transfer, invalid acceleration ordered	Activate security settings in the drive amplifier, such as speed monitoring, permissible position errors etc.
Motor heats up too much (measure temperature)	Rated power exceeded as duty cycle is too long	Adapt load cycle to the rated power of the motor
	Cooling insufficient	Fix cooling air power supply or open cooling air passages. Retrofit external fan if necessary
	Forcer housing is difficult to move	Check lubrication of the guideways, foreign bodies in the moving range.
	Ambient temperature is too high	Check permissible temperature range
	Load cycle has been modified	Calculate load cycle and adapt accordingly
	Drive amplifier motor commutation does not function properly	Adapt commutation parameters of the drive amplifier

Operating noise from the forcer	Relubrication required otherwise risk of bearing damage	Lubrication or consultation with HIWIN MIKROSYSTEM
The axis generates cracking noises when it is subject to control	EMC interference in the encoder signal	Encoder cables must be used separately with shielded sin and cos signal pairs
	Commutation incorrect	Optimize commutation parameters.
The forcer jerks while moving and generates operating noise that is not caused by the profile guideways	EMC interference in the encoder signal. Encoder cable plug connection defective. Pin bent in plug	Place motor cable and/or encoder cable shield in full contact with the grounding terminal of the amplifier, check pin in plug.
Position discrepancies after several hours of operation	-	Use mains filter to stabilize voltage

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10. Declaration

10.1 Declaration

Declaration of Incorporation

according to EC directive 2006/42/EC on machinery (Annex II 1. B)

Name and address of the manufacturer:
HIWIN MIKROSYSTEM CORP.
No.6, Jingke Central Rd.,
Taichung Precision Machinery Park,
Taichung 408226, Taiwan

Description and identification of the partly completed machine:

Product:	Linear Motor System
Type:	LMX. LMG. LMAP. NPS. LMSSA
Year of manufacture:	from 2021

It is hereby declared that the following essential requirements of the Machinery Directive 2006/42/EC have been fulfilled.
1.1, 1.3, 1.4, 1.5, 1.6, 1.7

Moreover, it is declared that the relevant technical documentation specified under Annex VII Part B has been compiled.
It is hereby explicitly declared that the partly completed machine complies with all of the pertinent conditions in the following EC Directives.
2006/42/EC
2014/30/EU
2014/35/EU

Mounting and connecting instructions defined in catalogues and technical construction files must be respected by the user. They are based on the following standards:
EN ISO 12100:2010
EN 60204-1:2018
EN 61000-6-2:2005
EN 61000-6-4:2007 / A1:2011

The manufacturer or the authorized person undertakes to transmit, in response to a reasoned request by the national authorities, the relevant documentation on the partly completed machinery.

This is without prejud ce to the intellectual property rights of the manufacturer!

Important note! The partly completed machinery may not be commissioned until it has been ascertained that the machinery into which this partly completed machinery is to be incorporated is compliant with the provisions of this Directive.

Taichung 408226, Taiwan		
14.07.2021	**TSAN-LIN CHEN, Executive Vice President**	Tsan-Lin Chen
(Place, Date)	(Surname, first name, and function of signatory)	(Signature)

11. Appendix

11.1 Glossary

- Accuracy

  This, or the better terminology, the inaccuracy, corresponds to the deviation between target and actual position. The accuracy along an axis is defined as the remaining difference of target and actual position, after other linear deviations are excluded. Such systematic or linear deviations can be caused by cosine error, angle deviation, ball screw error, thermal expansion, etc. For all target positions of interest in an application, it is calculated with the following formula:
  Maximum of sum of systematic target—actual-difference+ 2 sigma (standard deviation)
  Please do not confuse accuracy with repeatability.

- Acceleration

  This is the speed change per time unit, i.e, acceleration = speed / time or a = v / t.

- Acceleration time

  This is defined as the time a drive requires from start until achieving target speed.

- Attraction force (F_a)

  This is created between the primary and secondary parts of the ironcore linear motors which must be provided by the guide.

- Back EMF constant(K_V)

  This is the ratio of the back EMF voltage (rms) to the motor rotational speed or linear speed (rpm or m/s). The back EMF is the electromagnetic force, which is created at the movement of the coil in the magnetic field of permanent magnets, e.g. in a servo motor.

- Continuous force (F_c)

  Continuous force are also called nominal torque and nominal force. This is the force that linear motors can produce in continuous operation when continuous current of 100% load rate (duty cycle) is applied to the motor coil.

- Continuous current (I_c)

  Continuous current is defined as the maximum allowed current into each coil under continuous operation, and is also called nominal current. It is characterized when the motor warms up and stay at 80 ° C.

- Eccentricity

  This is the deviation of the center point of rotation of rotary tables from their position during rotation. It is created by centering and bearing tolerances.

- Force

  Force (in linear movements) is given for defined conditions, e.g., as continuous force or torque at:
  (1). 20 ° C ambient temperature
  (2). 80 ° C winding temperature
  (3). 100% rate of loading (duty cycle)
  or as peak force or peak torque.

- Force constant (K_f)

  This is a coil specific constant. The motor output force can be calculated by multiplying the force constant of the motor by input current: $F = I \times K_f$

- Guide deviation

  This is the deviation from the axis of stroke. It depends on horizontal straightness [also straightness] and vertical straightness [also flatness].

- Horizontal straightness

  Horizontal straightness is defined as the positioning error in Y-axis as the stage moves along X-axis, which is measured by laser interferometer system.

- Motor constant (K_m)

  Motor constant designates the ratio of generated force and dissipation power, and represents the efficiency of the motor.

- Peak current (I_p)

  Peak current is applied to coils for a short time to generate peak force. The maximum time for applying peak current is 1 second. After that, motor has to cool down to nominal operating temperature, before further peak current could be applied again.

- Peak torque, peak force (F_p)

  The peak torque [for rotary motion] or peak force [for linear motion] is the maximum force that a motor can generate for approximately one second with peak current I_p. While applying I_p into motor, it is operating near the non-linear range of motor. This is especially useful for acceleration and braking.

- Resolution

  Resolution is the smallest distance that the position measuring system can detect. The reachable step size is theoretically larger than resolution due to other additional factors.

- Repeatability

  Repeatability is the measure of how close a stage approach to a designated point in different runs. Repeatability should not be confused with absolute accuracy. A linear axis can have medium accuracy, but have good repeatability. Uni-directional repeatability can be measured in a way, that a target position is approached multiple times from an appropriately distance and the same approaching direction. In this way, the backlash will not have any effect. For measurement of bi—directional repeatability, the target position is approached from different directions, in which case the backlash will take effect.

- Stiffness

  Static stiffness stands for the mechanical resistance to deformation of a part or an assembly under external static payload. In the other hand, dynamic stiffness stands for the elastic resistance to deformation and movement of a part or an assembly under external dynamic payload (e.g. driving force).

- Step size

  The minimum step size is close to resolution. It is the smallest possible movement of a system. It depends on encoder, amplifier, mechanical structure, backlash, etc.

- Vertical straightness

  Vertical straightness is defined as the positioning error in Z-axis as the stage moves along X-axis, which is measured by laser interferometer system.

- Winding resistance R_{25}

  R_{25} is the winding resistance at 25° C. At 80° C, the winding resistance increases to approximately 1.2 x R_{25}

- Winding temperature (T)

  This is the permitted winding temperature. The actual motor temperature is dependent on the installation, cooling and operating conditions and consequently can only be determined in a concrete case and cannot be calculated.

11.2 Unit conversion

To convert the unit in column B to the unit in column A, multiply by the corresponding figure in the table.

- Mass

		B			
		g	kg	lb	oz
A	g	1	0.001	0.0022	0.03527
	kg	1000	1	2.205	35.273
	lb	453.59	0.45359	1	16
	oz	28.35	0.02835	0.0625	1

- Linear velocity

		B				
		m/s	cm/s	mm/s	ft/s	in/s
A	m/s	1	100	1000	3.281	39.37
	cm/s	0.01	1	10	3.281×10^{-2}	0.3937
	mm/s	0.001	0.1	1	3.281×10^{-3}	3.937×10^{-2}
	ft/s	0.3048	30.48	304.8	1	12
	in/s	0.0254	2.54	25.4	8.333×10^{-2}	1

- Force

		B		
		N	lb	oz
A	N	1	0.2248	3.5969
	lb	4.4482	1	16
	oz	0.2780	0.0625	1

■ Length

		B				
		m	cm	mm	ft	in
A	m	1	100	1000	3.281	39.37
	cm	0.01	1	10	3.281×10^{-2}	0.3937
	mm	0.001	0.1	1	3.281×10^{-3}	3.937×10^{-2}
	ft	0.3048	30.48	304.8	1	12
	in	0.0254	2.54	25.4	8.333×10^{-2}	1

■ Temperature

		B	
		°C	°F
A	°C	1	(°F - 32) x 5 / 9
	°F	(°C x 9 / 5) + 32	1

11.3 Tolerances and hypotheses

11.3.1 Tolerances

Standard tolerances for those dimensions which is without tolerance definition.

Table 11.3.1.1 Tolerances

Tolerances (mm)							
<6	6-30	30-120	120-300	300-600	600-1200	1200-2400	>2400
±0.1	±0.2	±0.3	±0.4	±0.5	±0.8	±1.0	±1.5

11.3.2 Hypotheses

Operating staff are trained in the safe operation practices for NPS and have read and understood this user manual in full. Maintenance staff maintain and repair the NPS in such a way that they pose no danger to people, property or the environment.

11.4 Supplementary formula

11.4.1 Start Motor Sizing

The following contents describe how to choose proper motor according to speed, moving distance, and payload inertia. The basic process for sizing a motor is:

(1). Decide motion profile and required parameters

(2). Calculate peak and continuous force

(3). Select motor

Symbols

X	:	Move distance (mm)
T	:	Move time (sec)
a	:	Acceleration (mm/s^2)
V	:	Velocity (mm/s)
M_L	:	Payload (kg)
g	:	Gravitation acceleration (mm/s^2)
F_P	:	Peak force (N)
F_c	:	Continuous force (N)
F_a	:	Attraction force between stator and forcer (N) applicable for NPS
F_i	:	Inertia force (N)
K_P	:	Force constant (N/Arms)
I_P	:	Peak current (Arms)
I_e	:	Effective current (Arms)
I_C	:	Continuous current (Arms)
V_0	:	Starting velocity (mm/s)

■ STEP 1 Decide motion velocity profile and required parameters

In order to determine the correct motor for a particular application it is necessary to be familiar with the motion equation.

➢ Motion equation

Basic kinematics equations are described as follows:

$$V = V_0 + aT$$

$$X = V_0 T + \frac{1}{2} a T^2$$

Where V is velocity, a is acceleration, T is move time and X is move distance.
You can choose two of the four parameters (V, a, T and X) as your designed parameters, then the last two parameters can be calculated by above equations.

➢ Motion velocity profile

(1). 1/3-1/3-1/3 trapezoid profile

If the distance (X) and move time [T] have been given, the most common and efficient velocity profile for point-to-point motion is the “1/3-1/3-1/3” trapezoid curve because it provides the optimal move by minimizing the power required to complete the move. It breaks the time of the acceleration, Strokeing, and deceleration into three segments as shown below.

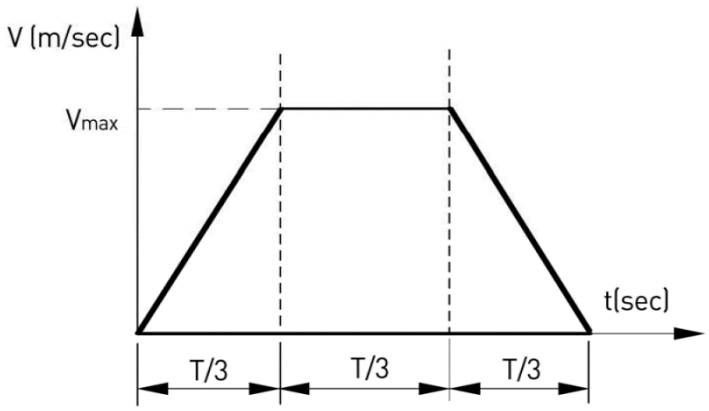


Figure 11.4.1.1 Trapezoid profile

$$V_{max} = 1.5 \times \frac{X}{T} \ (\text{Because } X = \frac{V}{2} \times \frac{T}{3} + V \times \frac{T}{3} + \frac{V}{2} \times \frac{T}{3})$$

$$a_{max} = \frac{V_{max}}{T/3} = \frac{4.5X}{T^2}$$

Note:

Herein the parameters are described as motion equation.

(2). 1/2-1/2 triangle profile

If X and T are given, another common motion profile is the 1/2-1/2 triangle profile. The motion is divided into two parts, namely acceleration and deceleration. The second motion velocity profile is shown as follows.

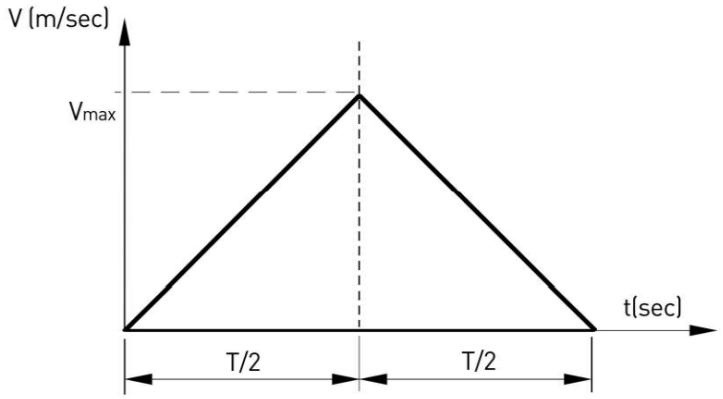


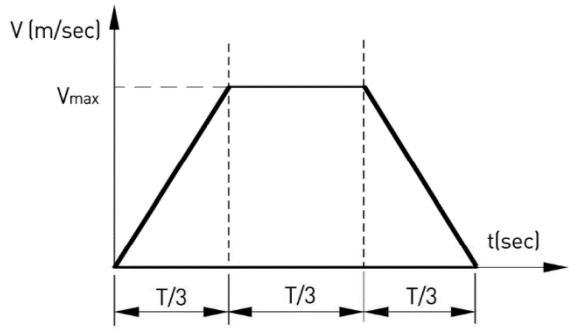
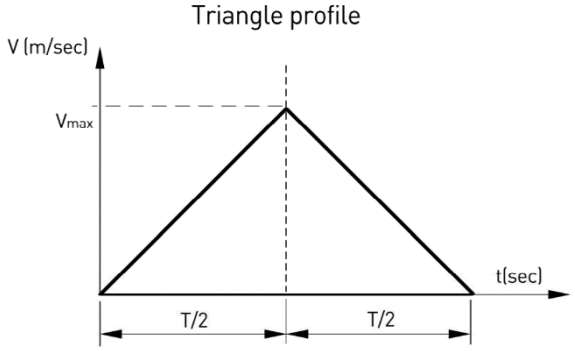
Figure 11.4.1.2 Triangle profile

$$V_{max} = 2 \times \frac{X}{T}$$

$$a_{max} = \frac{4X}{T^2}$$

(3). Some useful equations

Table 11.4.1.1

	1/3 -1/3-1/3 Trapezoid profile	Triangle profile
		
V	$1.5 \times \frac{X}{T}$	$2 \times \frac{X}{T}$, or $\sqrt{a \times X}$
a	$\frac{4.5X}{T^2}$	$\frac{4X}{T^2}$
t	$\frac{X}{V_{max}} + \frac{V_{max}}{a}$ $(\text{if} \frac{X}{V_{max}} \geq \frac{V_{max}}{a})$	

The acceleration required in the first motion velocity profile is bigger than that in the second motion velocity profile; therefore, the required motor size is bigger. When choosing second motion velocity profile, the chosen motor size is smaller, however, we need to verify the DC bus of driver is bigger enough, due to the higher velocity (V_{max}).

■ STEP 2 Determine peak force and effective force

The peak force can be calculated by the follow equation

$$F_P = M_L \times a_{max} + (M_L \times g + F_a) \times \mu = F_i + F_f$$

Where F_i is inertia force while F_f is friction force, and μ is friction factor.

In most cases, motions are cyclic point-to-point movements. Assuming a cyclic motion shown in the following profile with a pause time of t4 second, the effective force can be calculated as following formula:

$$F_e = \sqrt{\frac{(F_i + F_f)^2 t_1 + F_f^2 t_2 + (F_i - F_f)^2 t_3}{t_1 + t_2 + t_3 + t_4}}$$

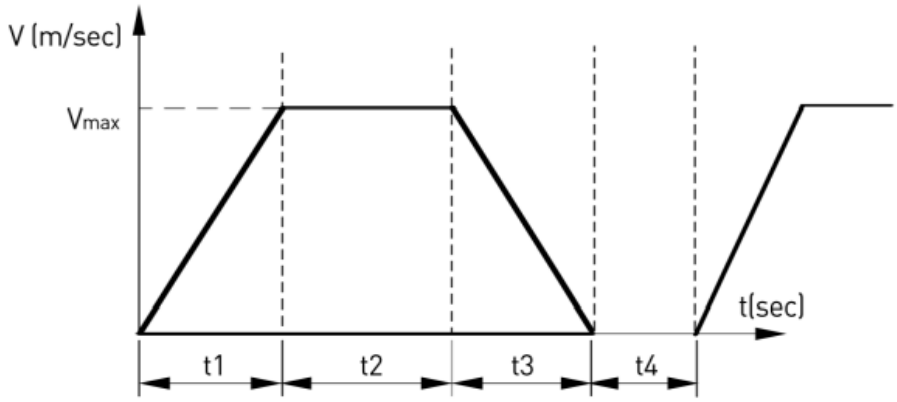


Figure 11.4.1.3 Profile

The peak current I_P and effective current I_e can be calculated by using motor force constant K_f.

$$I_p = \frac{F_p}{K_f}$$

$$I_e = \frac{F_e}{K_f}$$

- **STEP 3 Select motor by peak force and verify the current supply of motor**

From the HIWIN MIKROSYSTEM catalog, you can check the specifications of motor and choose an applicable motor by peak force, and then you can verify the current supply if it is fitted the specification as follows.

$$I_p = \frac{F_p}{K_f} < I_p \text{ (from specification of chosen motor)}$$

$$I_e = \frac{F_e}{K_f} < I_c \text{ (from specification of chosen motor)}$$

Regarding effective and continuous current, the ratio of I_e/I_c had better be less than 0.7 to attain some margin.

11.4.2 Linear Motor Sizing Example

For example, if Payload is 5 kg (moving mass of mechanism is 1 kg and payload is 4 kg), friction factor U is 0 01, distance is 500 mm, move time is 400ms and dwell time is 350ms.

At first, we can calculate the V_{max}, a_{max}, F_p and F_e by the formulas described above (choose the first motion velocity profile and LMSA Series)

$$V_{max} = 1.5 \times \frac{X}{T} = 1.5 \times \frac{0.5}{0.4} = 1.875(m/sec)$$

$$a_{max} = \frac{4.5 \times X}{T^2} = \frac{4.5 \times 0.5}{(0.4)^2} = 14.06(m/sec^2)$$

$$F_p = M_L \times a_{max} + (M_L \times g + F_a) \times \mu$$

$$= 5 \times 14.06 + 5 \times 9.81 \times 0.01 = 70.3 + 0.49 = 70.79(N)$$

$$F_e = \sqrt{\frac{[(70.3 + 0.49)^2 + 0.49^2 + (70.3 - 0.49)^2] \times 0.1333}{0.4 + 0.35}}$$

$$= 41.92(N)$$

In this case, we can choose motor of type LMSA11 which can provide up to 289(N) of peak force and continuous force 103(N), and the force constant is 48.6 N/A(rms). Then the current supply of motor can be determined as follows

$$I_p = \frac{F_p}{K_f} = \frac{70.79}{48.6} = 1.46(Arms) < 6.3(Arms)$$

$$I_e = \frac{F_e}{K_f} = \frac{41.92}{48.6} = 0.86(Arms) < 2.1(Arms)$$

$$\frac{I_e}{I_c} = \frac{0.86}{2.1} \times 100\% = 40.9 < 70\%$$

11.4.3 Sizing a Regen Resistor

11.4.3.1 Gather required information

To calculate the power and resistance of the regen resistor requires information about the amplifier and the motor. For all applications, gather the following information:

- Detail of motion profile, including acceleration and velocity
- Amplifier model number
- Applied line voltage to amplifier
- Toque/force constant of the motor
- Resistance (line-to-line] of the motor windings

For rotary motor applications, gather additional information:

- Payload inertia seen by the motor
- Inertia of the motor

For linear motor applications, gather additional information:

- Moving mass

11.4.3.2 Observe the properties of each deceleration during a complete cycle of operation

For each deceleration during the motion cycle, determine:

- Speed at the start of the deceleration
- Speed at the end of the deceleration
- Time over which the deceleration takes place

11.4.3.3 Calculate energy returned for each deceleration

The energy returned during each deceleration can be calculated by the following formulas.

Linear motor:

$$E_{dec} = \frac{1}{2} M_t (V_1^2 - V_2^2)$$

E_{dec}(joules): Energy returned by the deceleration

M_t(kg):Moving mass

V_1(meters /sec): Velocity at the start of deceleration

V_2(meters /sec): Velocity at the end of deceleration

11.4.3.4 Determine the amount of energy dissipated by the motor

Calculate the amount of energy dissipated by the motor due to current flow through the motor winding resistance using the following formula.

$$P_{motor} = \frac{3}{4} R_{winding} \left(\frac{F}{K_t}\right)^2$$

P_{motor}(watts): Power dissipated in the motor

$R_{winding}$(ohm): Line to Line resistance of the motor coil

F(N) : Force need to decelerate the motor

K_t(N/Amp): Torque constant for the motor

$$E_{motor} = P_{motor} T_{decel}$$

E_{motor}(joules) : Energy dissipated in the motor

T_{decel}(seconds) :Time of deceleration

11.4.3.5 Determine the amount of energy returned to the amplifier

Calculate the amount of energy that will be returned to the amplifier for each deceleration using the following formula.

$$E_{returned} = E_{dec} - E_{motor}$$

$E_{returned}$(joules) : Energy returned to the amplifier

E_{dec}(joules) : Energy returned by the deceleration

E_{motor}(joules) : Energy dissipated in the motor

11.4.3.6 Determine if energy returned exceeds amplifier capacity

Compare the amount of energy returned to the amplifier in each deceleration with the amplifier' s absorption capacity. The following formula is used to determine the energy that can be absorbed by the amplifier.

$$W_{capacity} = \frac{1}{2}C(V_{regen}^2 - (1.414V_{mains})^2)$$

$W_{capacity}$(joules):The energy that can be absorbed by the bus capacitor

C(farads):Bus capacitance

V_{regen}(volts):Voltage at which the regen circuit turns on

V_{mains}(volts):Mains voltage (AC) applied to the amplifier

11.4.3.7 Calculated energy to be dissipated for each deceleration

For each deceleration where the energy exceeds the amplifier' s capacity, using the following formula to calculate the energy that must be dissipated by the regen resistor.

$$E_{regen} = E_{returned} - E_{amp}$$

E_{regen}(joules):Energy that must be dissipated in the regen resistor

$E_{returned}$(joules): Energy delivered back to the amplifier from the motor

E_{amp}(joules):Energy that the amplifier will absorb

11.4.3.8 Calculate pulse power of each deceleration that exceeds amplifier capacity

For each deceleration where energy must be dissipated by the regen resistor, use the following formula to calculate the pulse power that will be dissipated by the regen resistor.

$$P_{pulse} = E_{regen} - T_{decel}$$

P_{pulse}(watts): Pulse power

E_{regen}(joules):Energy that must be dissipated in the regen resistor

T_{decel}(seconds): Time of deceleration

11.4.3.9 Calculate resistance needed to dissipate the pulse power

Using the maximum pulse power from the previous calculation, calculate the resistance value of the regen resistor required to dissipate the maximum pulse power.

$$R = V_{regen}^2 / P_{pulse\ max}$$

R(ohms): Resistance

$P_{pulse\ max}$: The maximum pulse power

V_{regen}: The voltage at which the regen circuit turns on

Choose a standard value of resistance less than the calculated value. The value must also be greater than the minimum regen resistor value specified by the amplifier supplier.

11.5 Optional accessories

There are no optional acessories with the nano precision stage.

Note: If having any special requests, please contact HIWIN MIKROSYSTEM or local distributors.

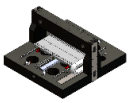
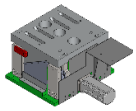
11.6 Customer request form

Company Name*: _____ Industry*: _____ Filled/Confirmed: _____/_____

Equipment*： _____ Application*： _____ Date： _____ Budget： _____

*Please fill all the required field①~⑥

①Stage Structure (multiple choices accepted)*

	Single Axis	Cross Table	Gantry	Bridge	Ball Screw	SBH Series	DLF Series	Custom
Type								【Please click the option on P3 or provide a sketch image】
Click	☐	☐	☐	☐	☐	☐	☐	☐

②Stage Installation (multiple choices accepted)*

Options: Ⓐ Horizontal Ⓑ Upside-down Ⓒ Wall-mounted Ⓓ Vertical Ⓔ Others						
E.g. ☐__Ⓐ__	Upper Axis ☐_____	Lower Axis ☐_____	Vertical Axis ☐_____	Rotary Axis ☐_____	Other ☐_____	Other ☐_____

③Operation Environment Ⓐ~Ⓓ (multiple choices accepted)*

Options	☐ General	☐ Temp. Range	☐ Clean room w/ constant temp.*(please fill routing information on P2)	☐ Vacuum
Spec	___°c ±1°c	___°c ± ___°c	Class ___@___°c ±1°c	___Torr or___mbar

④Input Voltage*

☐ 110V	☐ 220V	☐ 380V	☐ Other:_____V

⑤Motor Sizing (multiple choices accepted) (Please fill “NA” if not assigned)*

	☐ Upper Axis	☐ Lower Axis	☐ Vertical Axis	☐ Rotary Axis	☐ Other	☐ Other
Axis Name						
Forcer Qtys						
Motion Type	☐ LM ☐ BS	☐ LM ☐ BS	☐ LM ☐ BS		☐ LM ☐ BS	☐ LM ☐ BS
Payload(kg)/size				___(__L x__W)		
Stroke(mm)				±___°		
Velocity(m/s)				____rad/s		
Acceleration(m/s²)				____rad/s²		
Movement	☐P to P ☐Scan	☐P to P ☐Scan	☐P to P ☐Scan	☐P to P ☐Scan	☐P to P ☐Scan	☐P to P ☐Scan
PM System						
Repeatability(um)	±_____	±_____	±_____	±____arc sec	±_____	±_____
Accuracy(um)	±_____	±_____	±_____	±____arc sec	±_____	±_____

⑥Project Information*

Surface Finish	☐Standard Surface Finishing ☐Black
Electric Control System	☐Yes (Please Fill the Electric Control System Inquiry Form) ☐No
Source Inspection	☐Yes (On-site Inspection) ☐No
Packaging Method	☐None ☐Pallet ☐Wooden Box ☐HIWIN Standard

Remark: 1. Fields marked* are required (P1). For other requirement, please kindly fill P2~P4
2. For special requirement, please kindly fill option⑩ to show with sketch with some explanation.

【⑦~⑩ are optional fields, please fill them if required】

⑦Advanced Accuracy Requirements: (If required but not defined, please fill “HIWIN Design”)

	Upper Axis	Lower Axis	Vertical Axis	Rotary Axis	Other	Other
Note: For application of laser, optical inspection, exposure…etc. industry, please fill the geometric accuracy information as below:						
Vertical Straightness (um)	±	±	±	±	±	±
Horizontal Straightness (um)	±	±	±	±	±	±
Pitch (arc sec)	±	±	±	±	±	±
Yaw (arc sec)	±	±	±	±	±	±
Servo jitter(um)	±	±	±	±	±	±
Note: For application of low speed scanning, please fill the velocity ripple spec as below:						
Velocity ripple	___%@___ mm/s	___%@___ mm/s	___%@___ mm/s	___%@___ rad/s	___%@___ mm/s	___%@___ mm/s
Note: For application of high-speed point to point, please fill settling time as below:						
Settling time	__ms@__um	__ms@__um	__ms@__um	__ms@__rad	__ms@__um	__ms@__um

⑧Optional Accessories

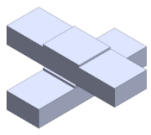
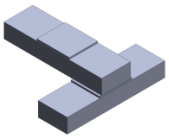
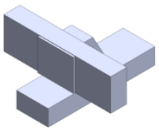
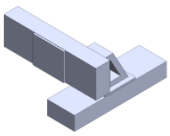
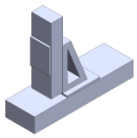
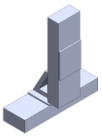
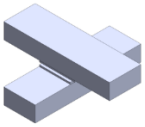
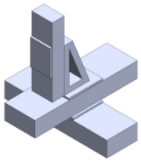
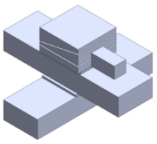
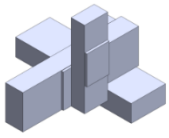
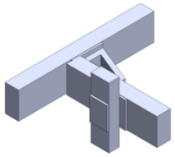
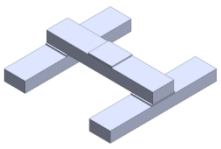
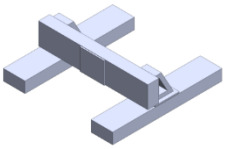
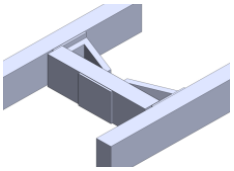
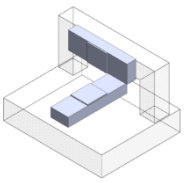
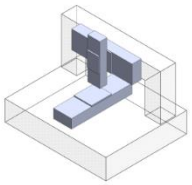
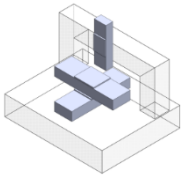
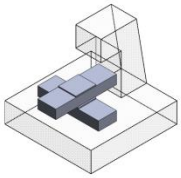
	Upper Axis	Lower Axis	Vertical Axis	Rotary Axis	Other	Other
Dust-proof	☐Cover ☐Bellow	☐Cover ☐Bellow	☐Cover ☐Bellow		☐Cover ☐Bellow	☐Cover ☐Bellow
Extension Cable	☐_____M	☐_____M	☐_____M	☐_____M	☐_____M	☐_____M
Cable Chain	☐	☐	☐		☐	☐
Note: For application of clean room, please kindly fill the routing information below. Choose 1 from option Ⓐ~Ⓓ						
*Routing information	Ⓐ☐N/A Ⓑ☐TBA Ⓒ☐Please Refer Attachment Ⓓ Spare Room for: ☐Wires Ø*_____pcs ☐ Tubes Ø*_____pcs ☐ Other Cables Ø*_____pcs					

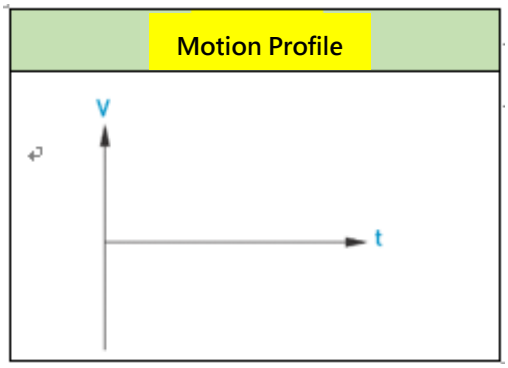
⑨ Optional Frame / Structure:

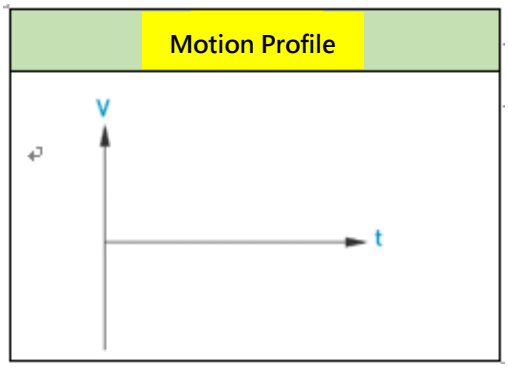
	Stage Standing Frame	Machine Housing Material	Door / Panel Material	Damper	Platform Base Material	Other
Type	☐Steel Welded ☐Aluminum Extrusion ☐Other_____	☐Steel Welded ☐Aluminum Extrusion ☐Other_____	☐Coated Steel Sheet ☐Acrylic Sheet ☐Other_____	☐Passive ☐Active	☐Granite ☐Casting ☐Other_____	

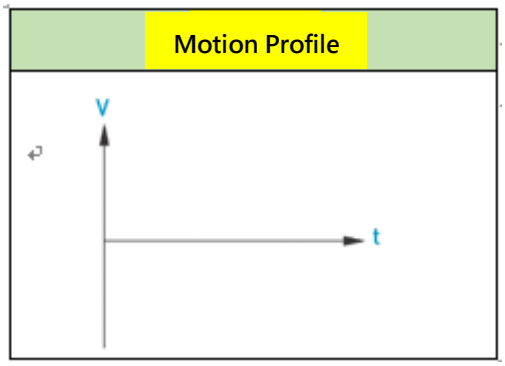
⑩ Special Requirements:

Special Drive Requirement	☐Specified Firmware Version: Ver._____ ☐Fieldbus Communication: _____ ☐Position Trigger / Vision on Fly
Special Application	
Special PM System	
Other Requirement	
Reference of existing case	☐Drawing No.:_____ ☐O/C：_____

Dual Axes Stage			
☐ 	☐ 	☐ 	☐ 
☐ 	☐ 	☐ 	
Tri-Axes Stage			
☐ 	☐ 	☐ 	☐ 
Gantry			
☐ 	☐ 	☐ 	
Bridge			
☐ 	☐ 	☐ 	☐ 







If there is special requirement on motion profile, please select one of above structure or provide sketch image.

Electric Control System:

Fields marked * are required.

*Power System	Input Voltage	☐ 110V ☐ 220V (Single phase) ☐ 220V (Three-phase) ☐ Other: _____V ☐ HIWIN design	Optional Parts	☐ Socket	Input Voltage: _____V Qty: _____pc(s)
	Connector Type	☐ H Type (Input Current<15A) ☐ T Type (Input Current<15A) ☐ Bare Wire ☐ Other: _____		☐ I/O Terminal	(1) Input Qty_____ ☐ NPN ☐ PNP ☐ Dry Contact (2) Output Qty: _____ ☐ NPN ☐ PNP ☐ Dry Contact Output Current _____mA
	UPS	☐ Yes _____KVA ☐ No		☐ None	
*Control Panel	☐ Electric Cabinet (Outside System)	(1) Installation Method: ☐ Vertical ☐ Horizontal ☐ Drawer Type (2) Material and Surface Treatment: ☐ Stainless Steel ☐ Aluminum ☐ Coated ☐ Non-Coated (3) Size： L:__mm, W:__mm, H:__mm (4) Distance From System:____ m	HIWIN Document	☐ Spare parts list(.pdf) ☐N/A	
			Screen	☐ Touchscreen ☐ Qty:___ ☐ Size: ____inches ☐ Non-touchscreen ☐ Qty:___ ☐ Size: ____inches ☐ None	
	☐ Wiring Panel (Inside System)		*Industrial Specification	☐ Required Certification: ☐ CE ☐ UL ☐ SEMI S2 ☐ Other: _____	
				Customer Wiring Method: ☐ Customer-supplied SOP ☐ HIWIN Standard	
	☐ HIWIN Design		*Designated Parts	☐ List of Designated Parts(.pdf) (.xls) ☐ None	
	☐ None			☐ List of Customer-supplied Designated Parts(.pdf) (.xls) ☐ None	
*Emergency Stop Function	☐ Power-off System (Retain Control Power) ☐ Disable System (Retain Control Power) ☐ HIWIN Design		Alarm	☐ Stack Light Buzzer ☐ Safety Light Curtains ☐ Other:_____☐ None (multiple choices accepted)	

Special Requirements: