

PATENT PENDING

IKO

Nano Linear

NT...V
NT



IKO *Clean Lubrication*
C-Lube 
Friendly to Maintenance
Gentle to the Earth

CAT-57152

**Accomplishes high productivity
in tight spaces.**

**Suite to micro electrical parts assembling
and inspection machines.**

IKO Nano Linear

NT

IKO Nano Linear

NT.V

Ultra compact size
Height: as low as 14 mm

Assembling functional parts more compactly and adopting IKO Linear Way L for the linear motion rolling guide, the table provides the maximum thrust of 25N with a height of only 14 mm.

Excellent clean performance

The linear scale sensor is arranged on the side of bed without using a moving cable. Only Miniature Linear Way makes mechanical contact. The product achieves a high level of cleanliness.

**Super acceleration/deceleration
and quick response**

The moving table that is as light as 170g provides the maximum thrust of 25N. IKO Nano Linear NT achieves high acceleration/deceleration up to 10G.

**Superior rest stability and speed
stability**

Superior rest stability has been achieved by a leading edge servo-technology. So this table can also be used as a high-accuracy positioning system. At a low-speed operation of 10 mm/s, the speed variation is $\pm 3\%$. At 100 mm/s, the speed variation is $\pm 0.3\%$. Nano Linear NT can thus achieve high-speed stability.

IKO Nano Linear NT...V / NT

As the result of thorough pursuit of downsizing, the sectional height of **IKO** Nano Linear motor table is as low as 14 mm (NT55V and NT60).

IKO Nano Linear uses, as the table guide, an **IKO** Linear Way which is well established in the field of small linear motion rolling guides. The linear motor table in combination with a linear motor and a high resolution linear encoder realizes highly accurate positioning.

IKO Nano Linear using the strongest neodymium magnet achieves large thrust power, high speed and quick response positioning in spite of its compact size.

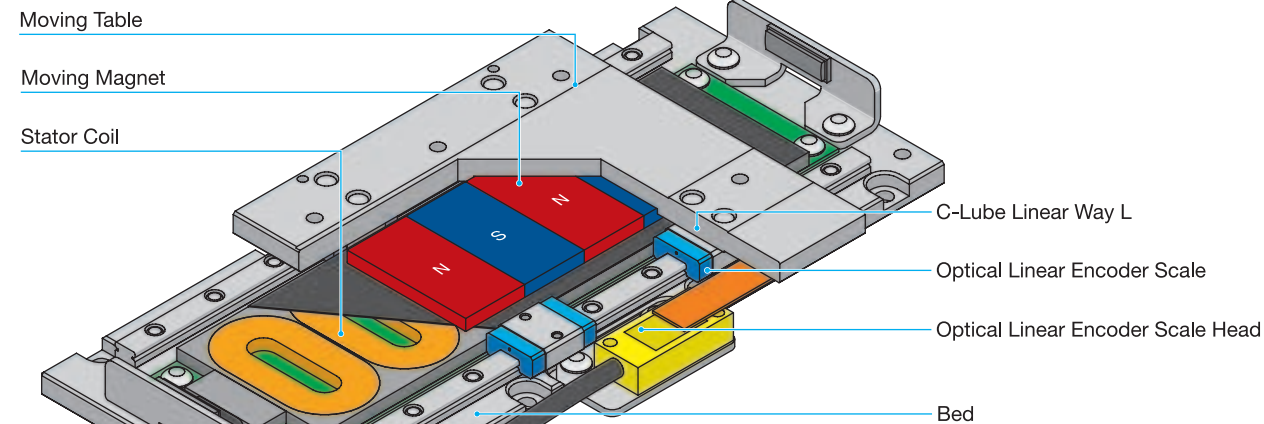
Thanks to an epoch-making driving system without using any moving cable, the mechanical contact part of this series is only Miniature Linear Way. This realizes a high level of cleanliness.

IKO Nano Linear is best suitable as a compact positioning mechanism for such as semiconductor/LCD-related manufacturing equipment, test equipment, electronic part assembling facility and so on which require clean environments.

There are two NT...V and NT... Nano Linear series: NT...V of high cost performance and NT... series of vertical operation specifications (as standard) and excellent basic characteristics.



Structure of Nano Linear Model: NT80V65

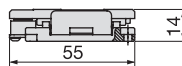
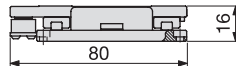
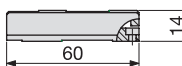
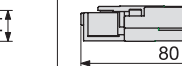
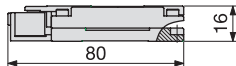


Principle of operation of Nano Linear

Nano Linear NT incorporates magnets and optical linear encoder scale in the moving element and air-core coils and optical linear encoder scale head in the stator densely. As shown in the right figure, the magnet and coil yoke generate a magnetic flux that always works vertical direction and a rotating magnetic flux is generated around the coil due to coil current, a force is applied to the coil in the horizontal direction. (Fleming's left-hand rule)

A unidirectional thrust can be continuously obtained by switching the coil current according to the vertical flux direction, so that the moving part can keep moving in one direction. Acceleration control by current level and feedback by the linear encoder are made for travel and accurate positioning.

Variation

	NT...V series					NT series						
Features	Amazingly low prices Realizes excellent cost performance by reducing the number of parts and reviewing part shapes. Simple structure of NT...V provides cost-effectiveness even in multi axes designing.					Vertical mounting structure available The NT series of vertical mounting structure is also available as standard. It incorporates balancing (spring) system. Enables construction of your design optimum positioning mechanisms.						
	Smallest in the series NT55V25, which is the smallest in the series, is as low as 14 mm in the sectional height, 55 mm in table width, and 120 mm in full length. Contributes to further downsizing of the positioning mechanism.					Enabling both micro feeding and high speed operation Enables high speed operation at a maximum speed of 1.0 m/s and a high resolution of 0.1 μm, that is, both micro feeding and high speed operation.						
	Simple system configuration Maximum 512 steps programmable controller is provided as standard. Simple system configuration realizes without top glade controller.					Provision of limit sensors as standard Incorporate +direction and –direction limit sensors in the table. These sensors detect noises and unexpected commands and stop the table. You can build a high safety system.						
												
Model	NT55 V25		NT55 V65		NT80 V25	NT80 V65	NT80 V120	NT60-25	NT60-65	NT80-120		
Dimension (mm)												
Stroke length (mm)	25	65	25	65	120	25	65	120				
Mass of moving part (g)	170		280			470	170			370		
Maximum thrust (N)	25		36				25			33		
Rated thrust (N)	7		8				7			7		
Resolution and maximum speed	Resolution at 0.1 μm.hour at 0.5 μm.hour					Maximum speed 0.27 m/s 1.3 m/s	Resolution at 0.1 μm.hour at 0.5 μm.hour					Maximum speed 1.0 m/s 1.5 m/s
Repeatability (μm)	± 0.5						± 0.5					
	Refer to P.7 for further information						Refer to P.15 for further information					

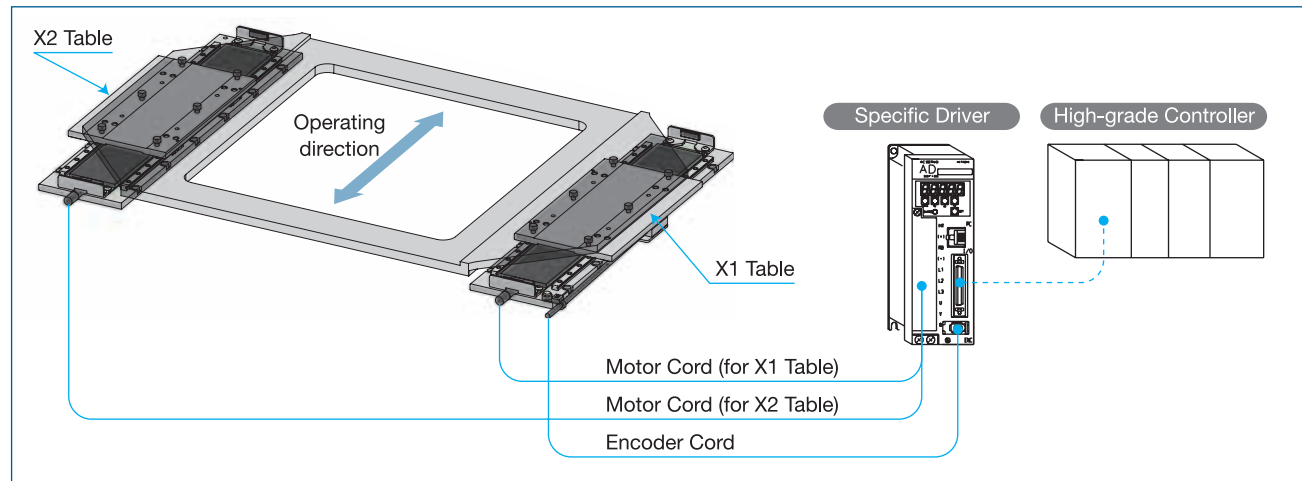
Applications of IKO Nano Linear for creating new positioning mechanisms

Two axes parallel operation

By firmly connecting two parallel linear motor tables and driving them together by a single specific driver, you can obtain large thrust force and stable attitude accuracy. This system is best suited to drive a double-housing equipment or bored stage.

Features of two axes parallel operation

- Larger thrust force by two axes driving
- Minimum table delay and torsion of housing by driving of left and right tables
- More accurate positioning with minimum table delay and torsion of housing
- Less expensive compared to synchronized operation

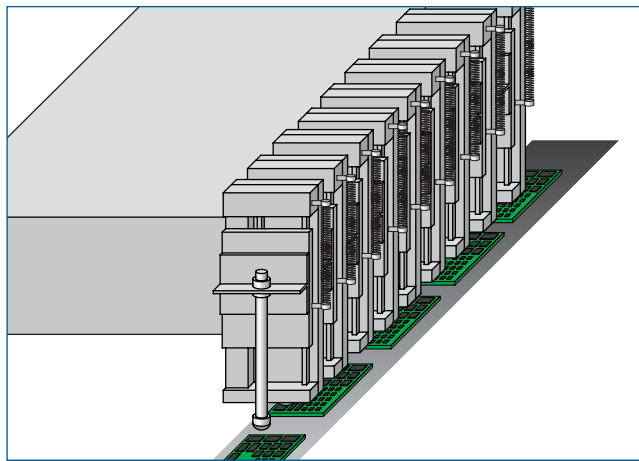


※ The two axes parallel operation is optional. IKO selects a specific driver fit for your driving condition. Consult IKO.

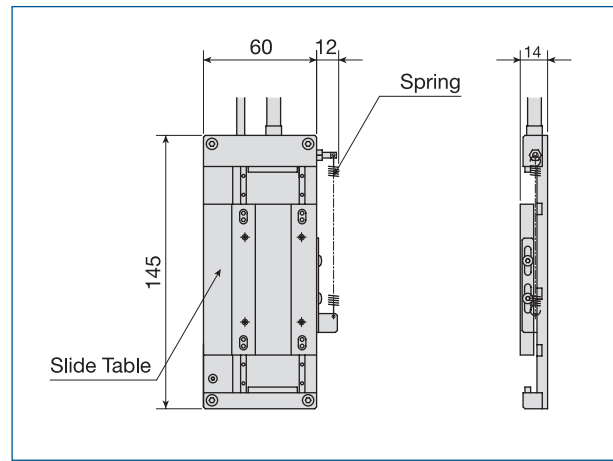
Vertical operation

IKO Nano Linear NT can be used in vertical structure by incorporated balancing (spring) system that prevents table dropping in power failure. Nano Linear NT enables the use in vertical structure. The spring type balancing mechanism can make the motor table smaller than the other balancing mechanism (using counter balances). So you can build up a multiple pick and place mechanism and the like utilizing the NT's original low sectional and compact features. For vertical operation specifications, IKO is ready to determine optimum specifications according to your driving condition.

► Multiple pick and place mechanism (Image)



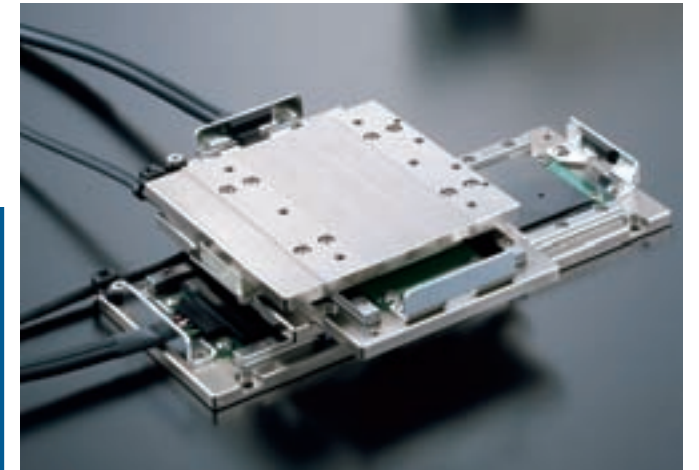
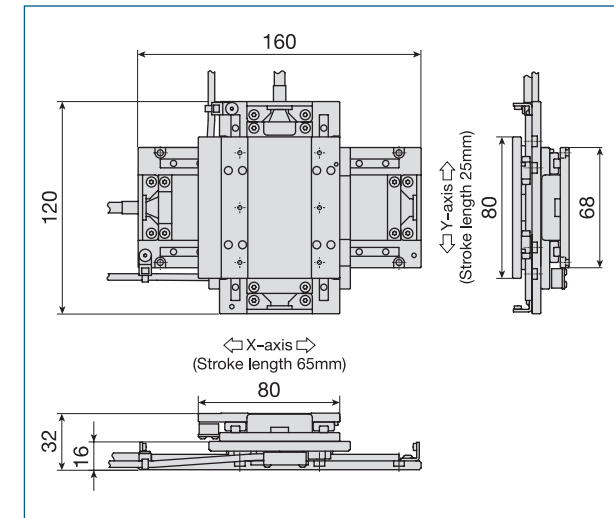
► Spring type balancing mechanism



※ The maximum carrying mass is 1kg.

X-Y stage

Two Nano Linear NT 80V tables can be assembled in X-Y stage. They can be mounted directly to each other without additional attachment. This allows total stage height to be very low.



※ In X-Y stages consists of NT80V, if NT80V25 comes as upper axis, the stages shall be assembled by IKO.

Special combinations and designs

Special structures are also possible per request by adequately combining Nano Linear excellent technologies. Consult IKO for further information.

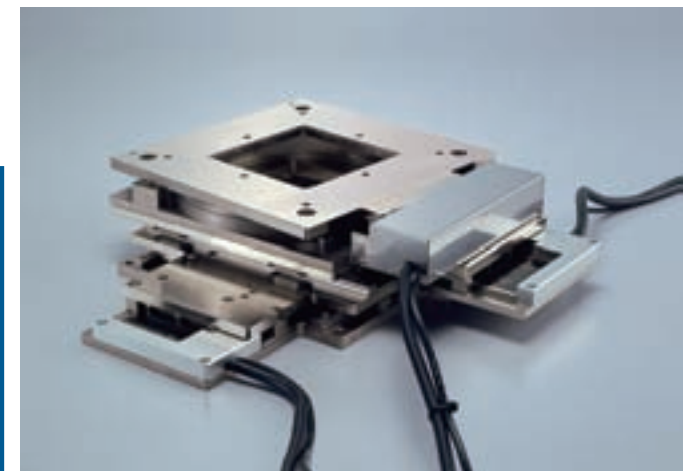
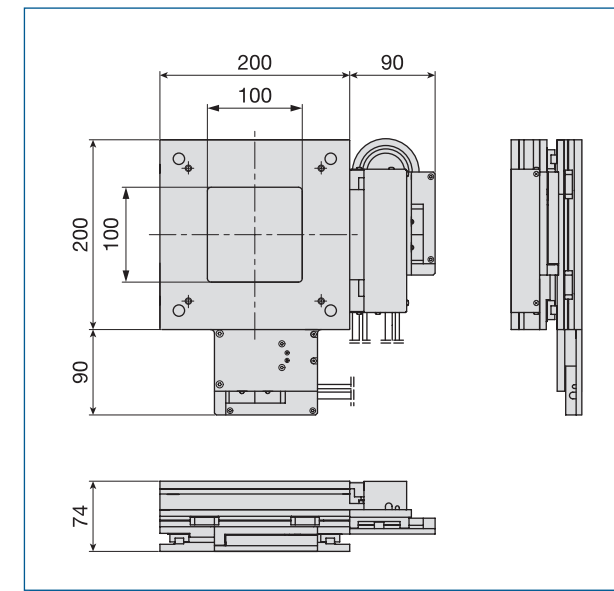
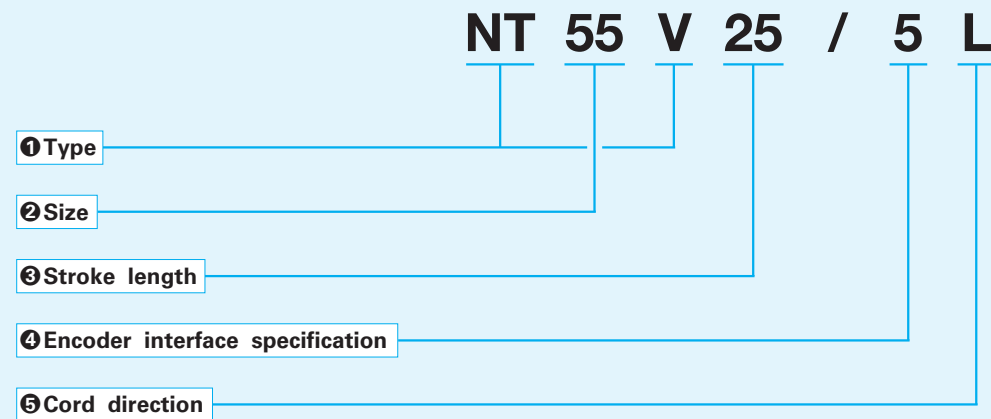


Table specification

Stroke length of X-axis : 25mm
Stroke length of Y-axis : 25mm
Tilting angle of θ -axis : ± 5 degree

Identification Number

Example of identification number



① Type	NT...V : Nano Linear NT...V
② Size	55 : Width 55mm 80 : Width 80mm
③ Stroke length	25 : 25mm 65 : 65mm 120 : 120mm (Applicable to NT80V)
④ Encoder interface specification	1 : 0.1 μ m 5 : 0.5 μ m
⑤ Cord direction	L : Left direction R : Right direction Cord direction is selected from Fig.1 shown below.

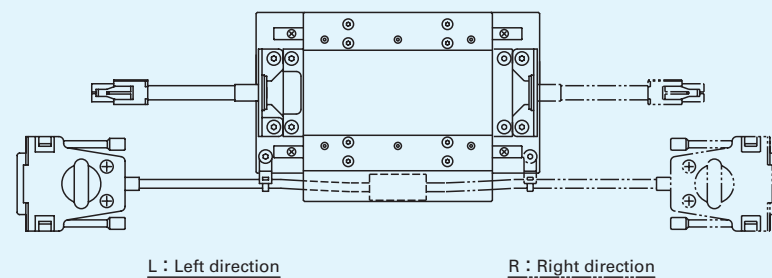


Fig.1 Cord directions

Specification and Performance

Table 1 Specification and Performance

Item \ Type		NT55V25		NT55V65		NT80V25		NT80V65		NT80V120	
Maximum thrust ⁽¹⁾	N	25				36					
Rated thrust ⁽²⁾	N	7				8					
Maximum load mass	kg	5									
Operative stroke length	mm	25		65		25		65		120	
Resolution	μm	0.1	0.5	0.1	0.5	0.1	0.5	0.1	0.5	0.1	0.5
Maximum speed	m/s	0.27	1.3	0.27	1.3	0.27	1.3	0.27	1.3	0.27	1.3
Repeatability	μm	±0.5 ⁽³⁾									
Mass of the moving part	g	170		170		280		280		470	
Total mass ⁽⁴⁾	g	420		500		680		830		1400	
Ambient temperature and humidity		0~40℃・20~80%RH (No condensation)									

Note⁽¹⁾ : The maximum holding time of maximum thrust is 1 sec.

⁽²⁾ : This value is applicable when Nano Linear NT...V is mounted on steel made solid mounting base and ambient temperature at 20°C.

⁽³⁾ : This indicates the value when the temperature of Nano Linear NT has become stable.

⁽⁴⁾ : The mass of the cord is not included.

●NT55V

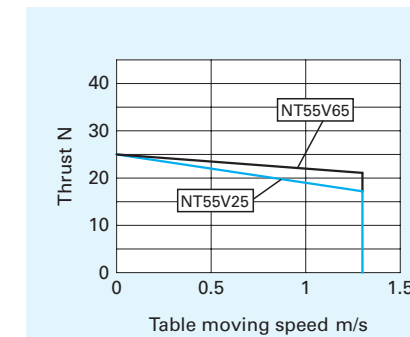


Fig.2 Thrust Characteristics of NT55V

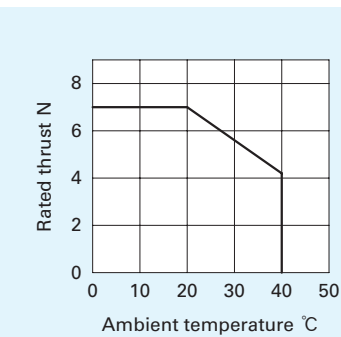


Fig.3 Rated thrust characteristics of NT55V

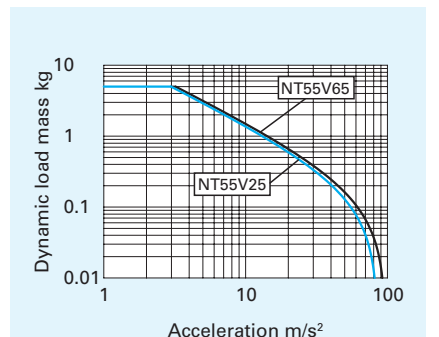


Fig.4 Dynamic load mass of NT55V

Remark : This value is applicable when Nano Linear NT...V is mounted on metal.

Remark : This value is calculated from the thrust at the table moving speed of 500mm/s.

●NT80V

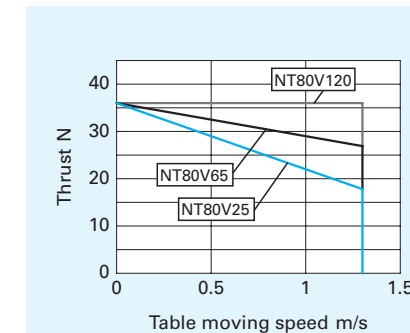


Fig.5 Thrust Characteristics of NT80V

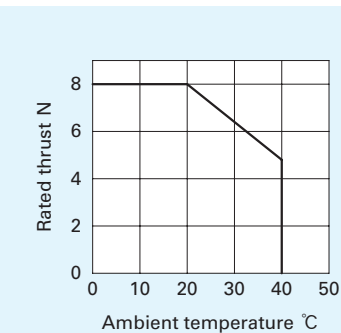


Fig.6 Rated thrust characteristics of NT80V

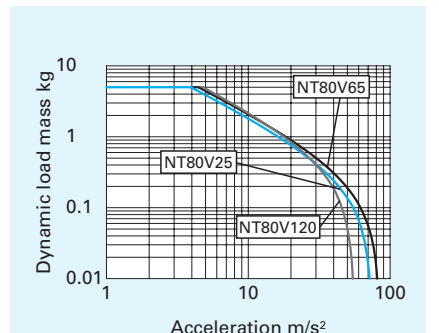


Fig.7 Dynamic load mass of NT80V

Remark : This value is applicable when Nano Linear NT...V is mounted on metal.

Remark : This value is calculated from the thrust at the table moving speed of 500mm/s.

1N=0.102kgf=0.2248lbs.
1mm=0.03937inch

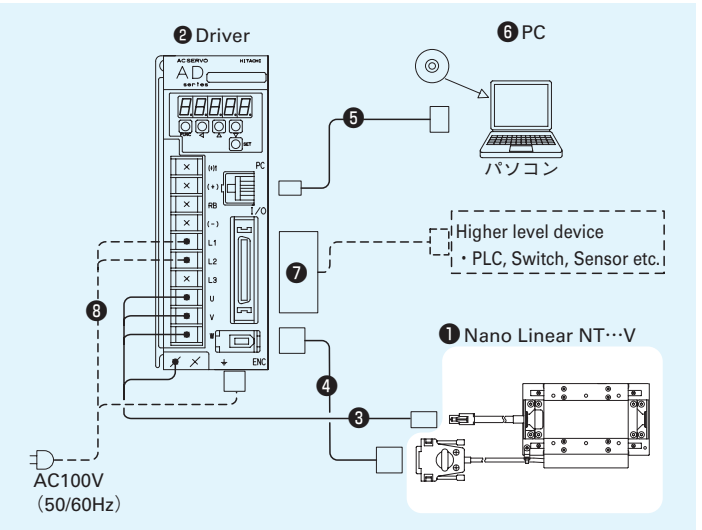
System Configuration

Dedicated driver is required to operate Nano Linear NT...V. Models and applicable drivers are shown in Table 2.1 and system configuration is shown in Table 2.2. For specification of driver, refer to page 11. When ordering, indicate the type shown in Table 2.1 and 2.2.

Table 2.1 Models and applicable drivers

①Model	②Driver
NT55V25	ADAX3-R5ML2-N 40
NT55V65	ADAX3-R5ML2-N 50
NT80V25	ADAX3-R5ML2-N 10
NT80V65	ADAX3-R5ML2-N 20
NT80V120	ADAX3-R5ML2-N 30

Table 2.2 System configuration



No.	Item	Model code
③	Motor relay cord (3m ⁽¹⁾)	TAE20G7-AM03
④	Encoder relay cord (2m ⁽¹⁾)	TAE20R4-EC
⑤	PC connecting cord (2m)	ADCH-AT2 (PC side D-sub 9pins)
⑥	Setup software	AHF-P02
⑦	I/O connector ⁽²⁾	TAE20R5-CN
⑧	Power cable	Prepared by costomer

Note⁽¹⁾ : For the special length cord, contact IKO for further information.
⁽²⁾ : Manufacturer: Sumitomo 3M, 10150-3000PE (Plug)/10350-52F0-008 (Housing)

Parameter setting of driver

Initial setting of driver parameter is required to operate Nano Linear NT...V. Parameter setting of driver is operated by setup software.
 Setup software and PC connecting cable are not supplied with the driver. They can be shared with multiple drivers, but at least one of each is required. Please order them accordingly.

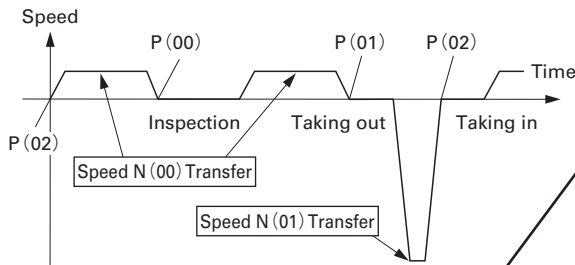
I/O connector

For servo on and alarm reset of driver, sending signal to I/O terminal is necessary.
 Cord for I/O terminal needs to be prepared by the customer. However, I/O connector is available from IKO.

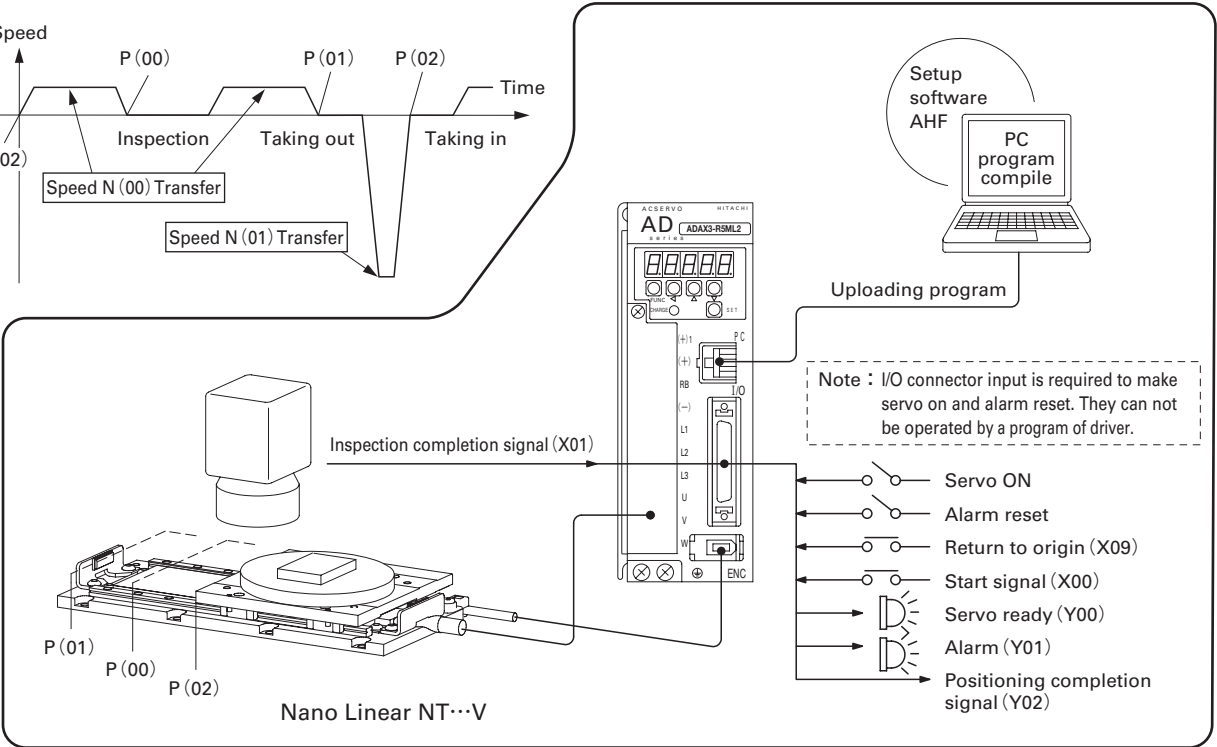
System Example

By using programming function of dedicated driver, NT...V can be operated by a simple system configuration that does not require higher level devices. System configuration and programming sample are shown as below.

Operation pattern



System configuration



Setup software operating windows and programming samples

Positioning data window

Moving speed and acceleration/ deceleration data window

Programming window

←Waiting inspection completion input X (01) ON.
 ←Positioning completion signal OFF.
 ←Moving P (00) at speed N (00)
 ←After moving completion, positioning completion signal is ON.
 ←Waiting inspection completion input X (01) ON.
 ←Positioning completion signal OFF.
 ←Moving P (01) at speed N (00)
 ←After moving completion, positioning completion signal is ON.
 ←Waiting inspection completion input X (01) ON.
 ←Positioning completion signal OFF.
 ←Moving P (02) at speed N (01)
 ←After moving completion, positioning completion signal is ON.
 ←Go to LOOP

1N=0.102kgf=0.2248lbs.
 1mm=0.03937inch

Driver (with operating program function)

- Maximum 512 steps of programming inputs are possible due to basic PLC function.
- Easy positioning operation by simple programming language.
- Position command data 100 points and speed command data 16 points can be memorized.
- Control with 12 points of input, 8 points of output and analogue input (0 to 10V) are possible.
- Operating by pulse train input is also possible.

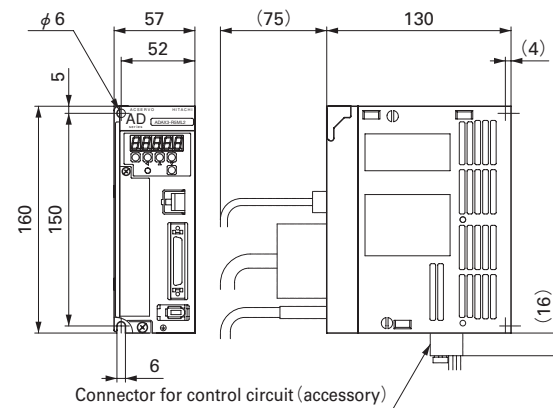


Table 3 Specification of driver

Item	Model	ADAX3-R5ML2-N□□
General specification	Continuous rated current(Arms)	0.9
	Instantaneous maximum current(Arms)	2.7
	Power supply capacity(kVA)	0.3
	Power supply(Main)	Single phase100~115V+10/-15%
	Power supply(Control circuit)	50/60Hz±5%
	Protection ⁽¹⁾	Open IP00
	Control method	Line sinusoidal phase modulation PMW method
	Control mode	Position control / Speed control / Thrust control
	Feed back	A, B, Z phases incremental encoder (Line driver: AM26LS31 equivalent) Power voltage 5V±10%, Consumption current : max280mA, Maximum frequency 4MHz (×4 Multiplication)
Specification of input and output	Speed command / Limit input	Analog input: 0 to ±10V / Maximum speed (Gain setting possible)
	Thrust command / Limit input	Analog input: 0 to ±10V / Maximum thrust (Gain setting possible)
	Position command	Line driver signal (2Mpps or less) ①+direction pulse / -direction pulse ②Code input / Command pulse ③90 degree phase, 2 phase pulse command (maximum frequency 500kpps) Selected from ① to ③
	Input signal	DC12/24V signal input (sink or source compatible) (DC24V power supply is incorporated.) ①Servo ON ②Alarm reset ③Control mode change ④Thrust limit ⑤+direction movement disabled ⑥+direction movement disabled ⑦Multiple speed 1 / Electric gear ⑧Multiple speed 2 ⑨Speed proportion control / Gain switch ⑩Speed zero clamp / External trip (Temp. signal) ⁽²⁾ ⑪Origin limit switch ⑫Return to origin ⑬Pulse train input enabled / +direction signal ⑭Deviation counter clear / -direction signal
	Output signal	Open collector signal output (Sink output) ①Servo ready ②Alarm ③Positioning completion ④Speed attainment / Alarm code1 ⑤Detecting zero speed ⑥Releasing brake ⑦Thrust restriction on / Alarm code 2 ⑧Overload prior notice / Alarm code 3
	Encoder	A, B phase signal output, Z phase signal output: Line driver and open collector signal output
Internal function	Monitor output	2ch, 0 to ±3V output Detected speed, Thrust command etc. can be selected for output.
	Built-in operator	5 figures monitor, Key input ×5
	External operator	Windows95/98/Me, WindowsNT/2000/XP Connectable to PC (By RS-232C port)
	Regenerating brake	Built-in (Without Braking resistance)
	Dynamic brake ⁽³⁾	Built-in (Operating condition settable)
Operation environment	Protection function	Current surge, Overload, Brake overload, Main circuit over voltage, Memory error, CPU error, Main circuit low voltage, CT error, Earth fault at servo on, External trip input (Motor temperature error), Power module error, Encoder error, Position deviation error, Position monitoring time error, Speed deviation error, Over speed error, Operating area error, Operation disabling error, Servo amplifier temperature error, Matching error, Invalid command error, Nesting time error, Run error, Magnetic polar position estimation error, Magnetic polar position estimation undone
	Ambient temperature in operation / Storage temperature ⁽⁴⁾	0~55°C/-10~70°C
	Humidity in operation	20~90%RH (No condensation)
	Vibration and impact ⁽⁵⁾	5.9m/s ² (0.6G) 10~55Hz
	Operating place	Altitude 1000m or less, Indoor (No corrosion gas, no dust)
	Mass(reference) (kg)	0.8

Note⁽¹⁾ : Protection method conforms to JEM1030 standard.

⁽²⁾ : Applicable when temperature sensor signal goes to external trip input.

⁽³⁾ : Please use dynamic brake as emergency stop.

⁽⁴⁾ : Storage temperature is also applied in transportation.

⁽⁵⁾ : Test method conforms to JISC0040 standard.

Table 4 Programming specification of driver

Item		Specification
Language specification	Language type	BASIC Like
	Program capacity	512 Steps (Memory in driver is 512 steps, within 6k bites.)
	Supporting function for programming	Text input, Display (Windows®95/98/NT/2000/XP) Grammar check of program (Windows®95/98/NT/2000/XP) Loading program, all clear Single step Break point
	Run specification	Interpreter type 1.12ms/command Subroutine call : 8 nests maximum
Input/Output function	External digital Terminal input	Terminal signal / Open collector input (Internal power supply DC24V is available.) Servo ON, Alarm reset, General input terminal 12 points X(00) to X(11)
	External output	General output terminal 8 points Y(00) to Y(07)
	External analog input	2 points XA(0) to XA(1)
Preset language	Variable	Position : P (00) to P (99) (100 points) Speed : N(00) to N(15) (16 points) Thrust : T (00) to T (15) (16 points) Acceleration time : ACC(0), ACC(1) (2 points) Deceleration time : DEC(0), DEC(1) (2 points)
	Command	Program command (for~next, ifs~then~else~end if, until~loop etc.) Motion program (mov, speed, nchg, smov etc.)
Operator		+, −, *, /, and, or etc.

Remark : Windows® is a trade mark of Microsoft Corporation in USA and other countries.

Setup Software

- Setting, referring, change, print and save of driver parameter can be done.
- Real time monitoring of operation and output is possible.
- Speed and electric current are displayed.
- Helping test run and gain tuning.
- Edit, compile, download and upload of program can be done.

Table 5 Operating environment of setup software

Item	Condition
PC	DOS/V PC
	Memory : 32M bites or larger
	Free area of hard disk : 30M or larger
	Display graphic resolution : 800X600 or larger recommended
OS	Windows® 95/98/Me/XP Windows NT®, Windows2000®

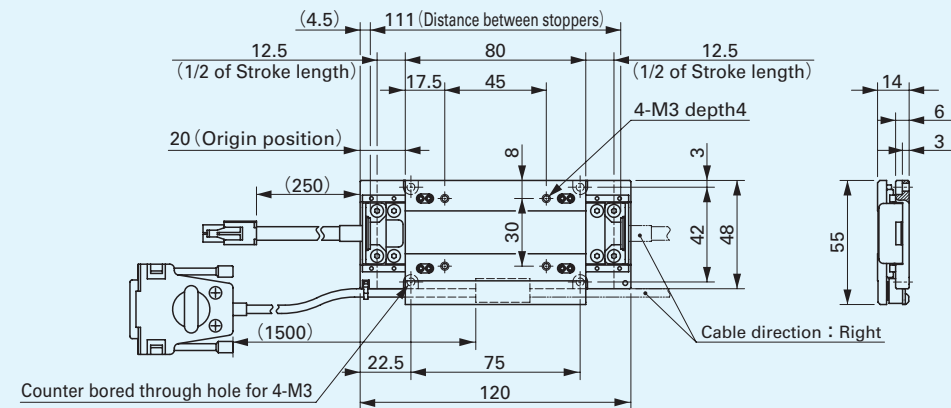
Remark : Windows® is a trade mark of Microsoft Corporation in USA and other countries.

1N=0.102kgf=0.2248lbs.
1mm=0.03937inch

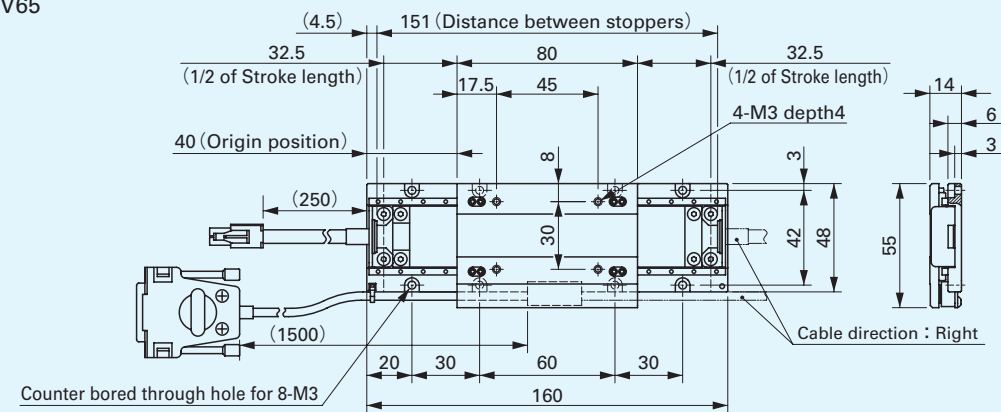
Nano Linear NT...V

NT...V

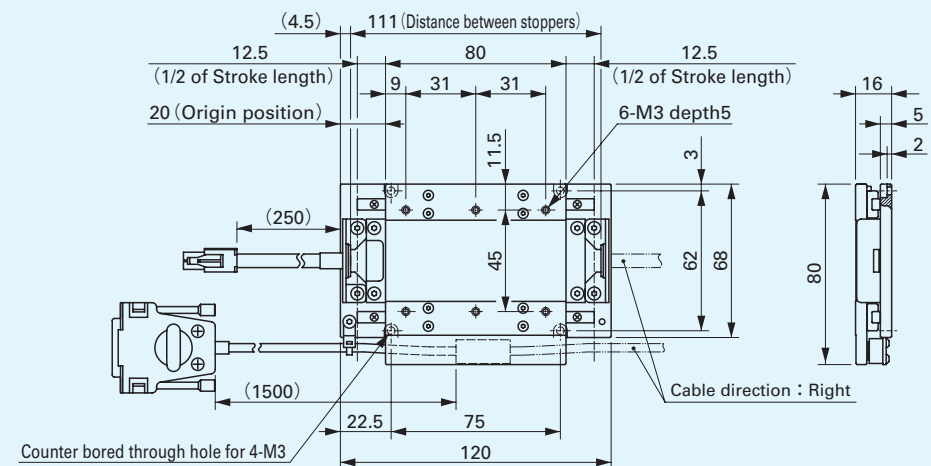
●NT55V25



●NT55V65



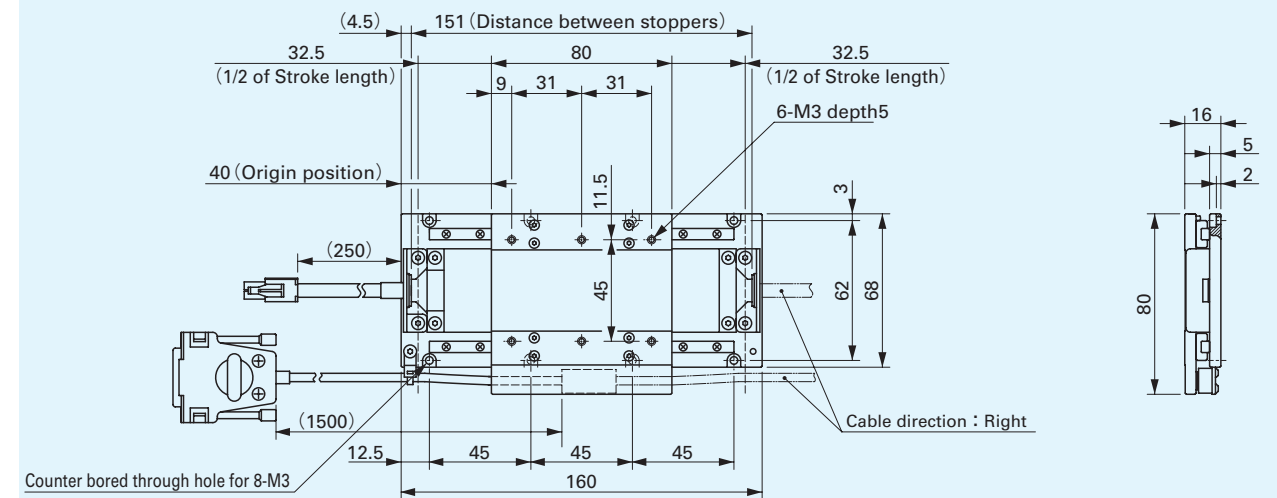
●NT80V25



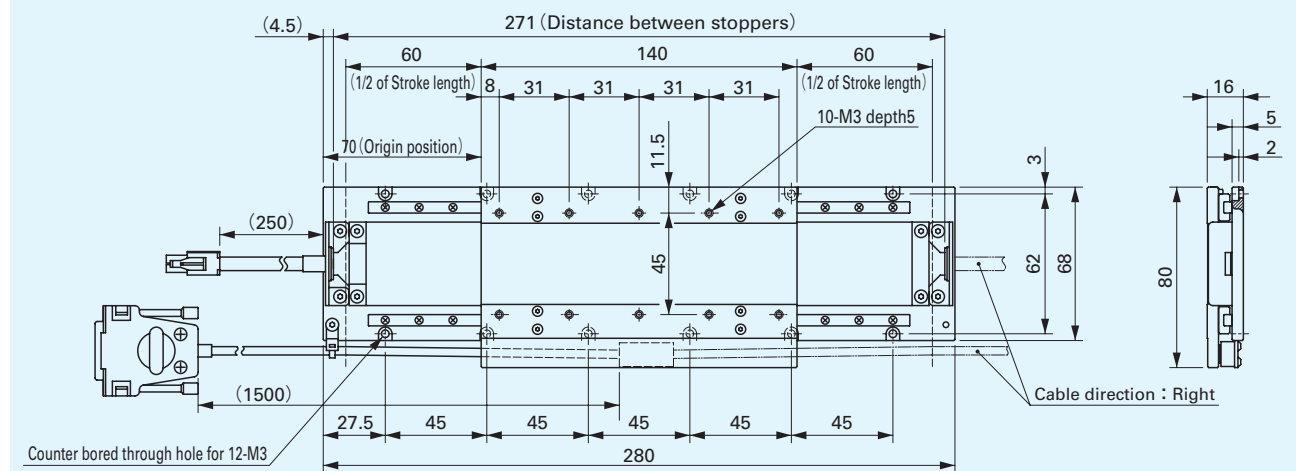
Nano Linear NT...V

NT...V

●NT80V65



●NT80V120



- Remark : 1. In case of standard system, a program of driver operates return to origin. Moving table returns the origin after contacting end stopper.
2. In case of standard system, overrun limit is detected by software limit of driver. Distance can be set by the parameter of driver. Software limit is valid in position control mode only. In case of speed/thrust control mode, please consider external sensors accordingly.
3. If NT80V25 comes on the upper axis in XY axis specification,  shall build the assembly.

Identification Number

For IKO Nano Linear NT, the 3 stroke lengths of 25mm, 65mm and 120mm are available. Desired resolution can be selected by specifying the encoder interface.

An example of identification number of Nano Linear NT is shown below.

Example of identification number

NT

60 – 25

/

5

A

①Type

②Size and stroke length

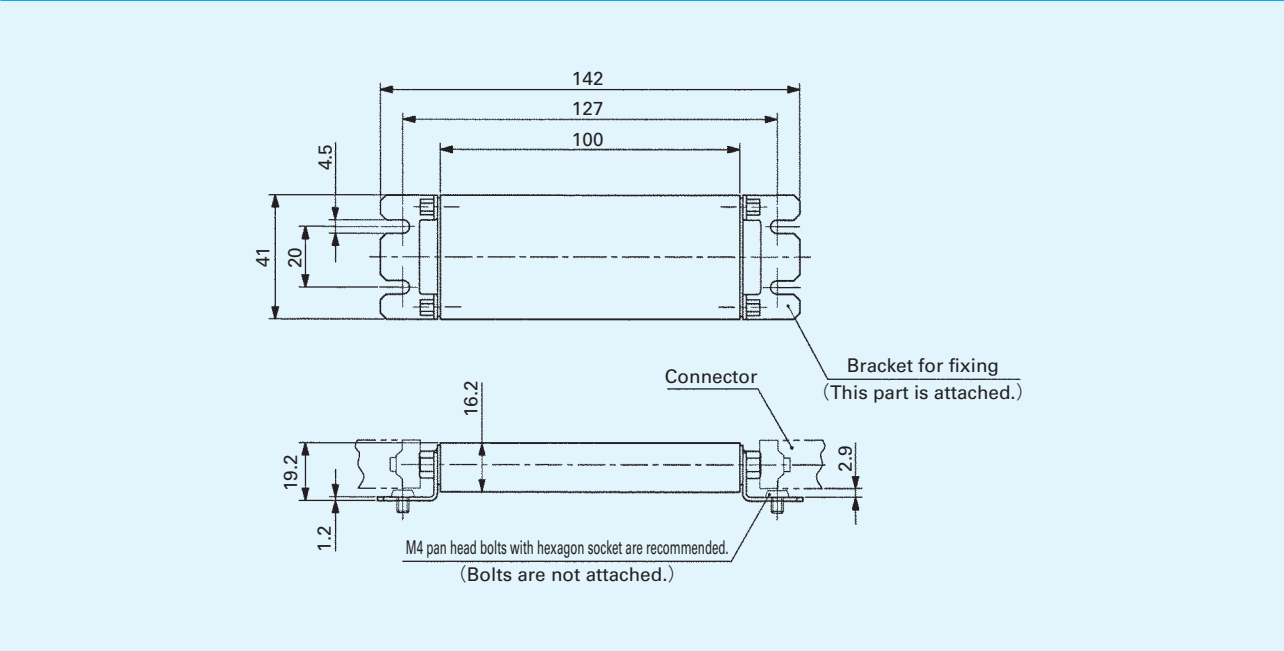
③Encoder interface specification

④Connector specification

①Type	NT : Nano Linear NT
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②Size and stroke length	60- 25 : Width 60mm Stroke length 25mm 60- 65 : Width 60mm Stroke length 65mm 80-120 : Width 80mm Stroke length 120mm
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③Encoder interface specification	5 : With an interface (TAE2092-5IF) for a resolution of 0.5 μm 1 : With an interface (TAE2091-1IF) for a resolution of 0.1 μm
The encoder interface is connected to the encoder cord of Nano Linear NT for use. By specifying encoder interface, desired resolutions can be selected.	



④Connector specification	A : Connector for the dedicated driver TDL1-1600 B : Connector for the dedicated driver TDL1-1601
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For Nano Linear NT, 2 types of dedicated drivers are available. Connector types defter depend on the driver to be used. Specify the connector according to the driver type.

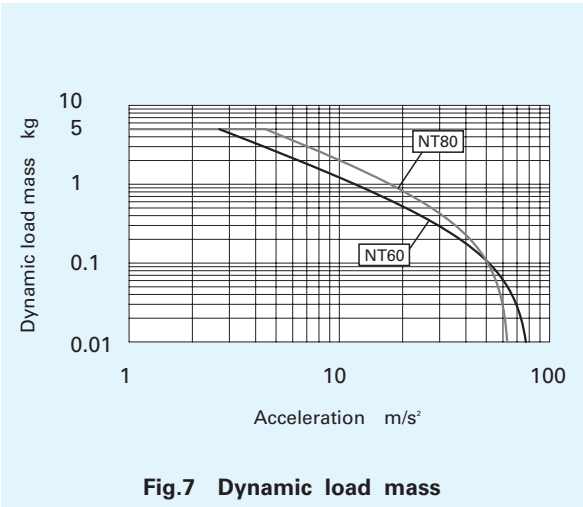
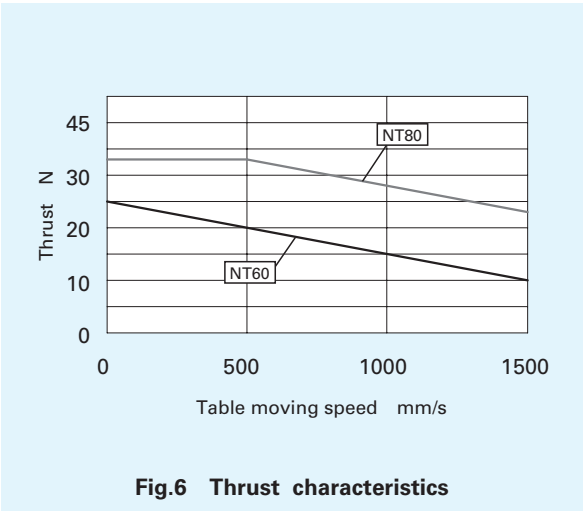
Specifications and Performance

Table 1 Specifications and Performance

Model		NT60-25		NT60-65		NT80-120	
Item							
Maximum thrust ⁽¹⁾	N	25		25		33	
Rated thrust ⁽²⁾	N	7					
Maximum load mass	kg	5					
Effective stroke length	mm	25		65		120	
Resolution	μm	0.5	0.1	0.5	0.1	0.5	0.1
Maximum speed	m/s	1.5	1.0	1.5	1.0	1.5	1.0
Repeatability	μm	±0.5 (°)					
Mass of the moving part	g	170		170		370	
Total mass ⁽⁴⁾	g	530		650		1300	
Ambient temperature and humidity		0~40℃・20~80%RH (Keep dewdrop free)					

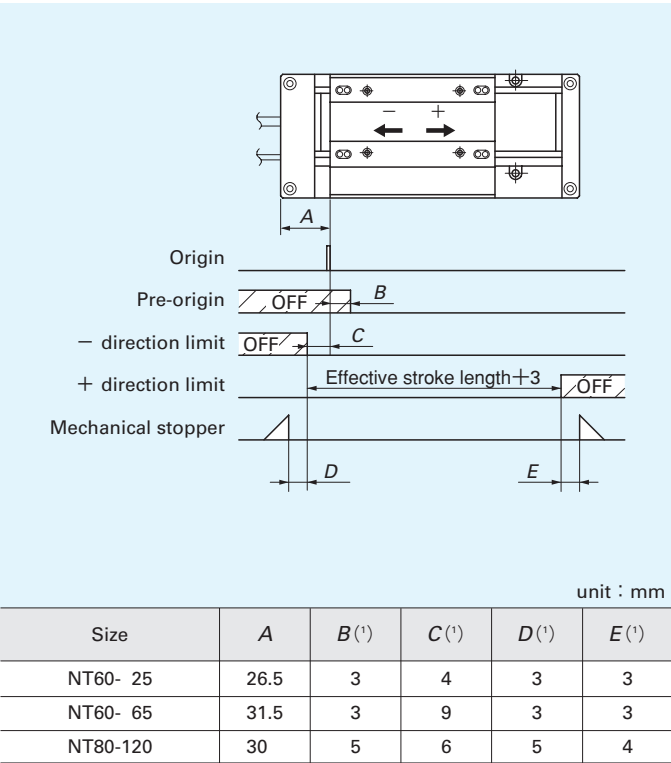
Note⁽¹⁾ : The maximum holding time of maximum thrust is 1 sec.
⁽²⁾ : This is the value when environment temperature at 20°C and the table is mounted on steel made solid base.
⁽³⁾ : This indicates a value when the temperature of Nano Linear NT has become stable.
⁽⁴⁾ : The mass of the cord is not included.

Remark : If this product to be used for a vertical axis, contact IKO for further information.



Remark : This value is calculated from the thrust at the table moving speed of 500mm/s.

Table 7 Timing chart of sensors



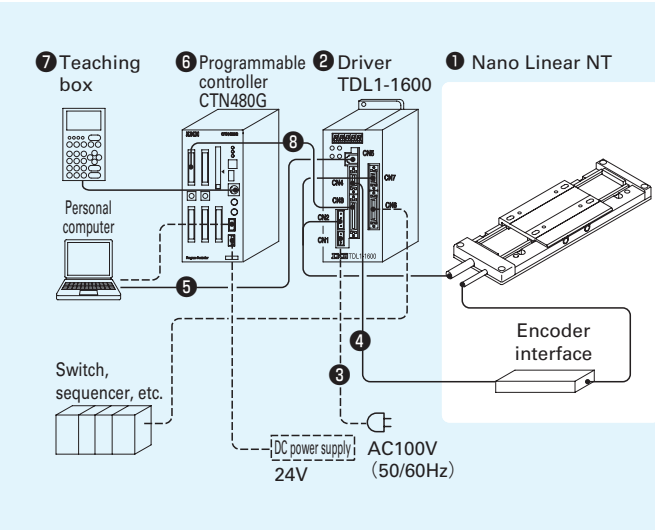
Note⁽¹⁾ : Values in the table are reference only.
Remark : Sensors are incorporated in the table, and each signal to be out-put from the driver.

System Configuration

Two types of dedicated drivers are available for Nano Linear NT and the system configuration depends on the driver to be used.

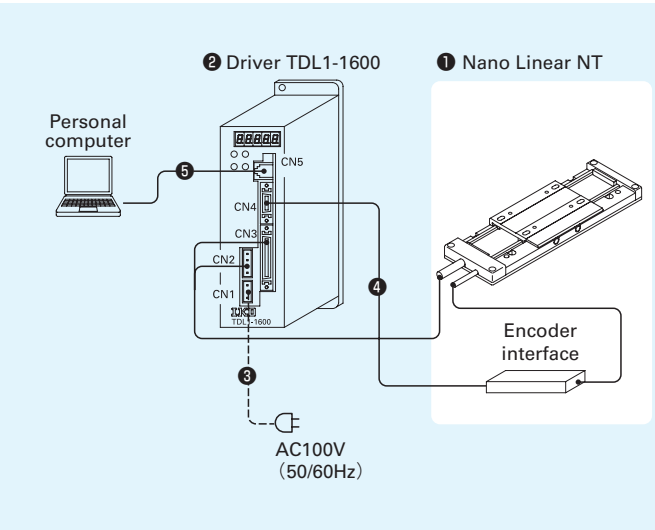
Table 8 shows a system configuration when the driver TDL1-1600 is used, and Table 9 shows a system configuration when the driver TDL1-1601 is used. For the specifications of each driver, see the information pertaining to drivers on page 18.

Table 8 System configuration with driver TDL1-1600



Remark : The length of the encoder cord and the pulse limit cord is 1.5m. The length of the RS232C cord is 2m.

Table 9 System configuration with driver TDL1-1601



Remark : The length of the encoder cord is 1.5m. The length of the RS232C cord is 2m.

No.	Item	Model code
1	Nano Linear NT	NT60···/A NT80···/A
2	Driver	TDL1-1600
3	Power cable	Prepared by customer
4	Encoder cord	TAE2088-EC
5	RS232C cord	TAE2089-RSP (Dsub25-pin) TAE2090-RSD (Dsub 9-pin)
6	Programmable controller	CTN480G
7	Teaching box	TAE10M5-TB
8	Pulse limit cord	TAE10R6-LD

No.	Item	Model code
1	Nano Linear NT	NT60···/B NT80···/B
2	Driver	TDL1-1601
3	Power cable	Prepared by customer
4	Encoder cord	TAE2088-EC
5	RS232C cord	TAE2089-RSP (Dsub25-pin) TAE2090-RSD (Dsub 9-pin)

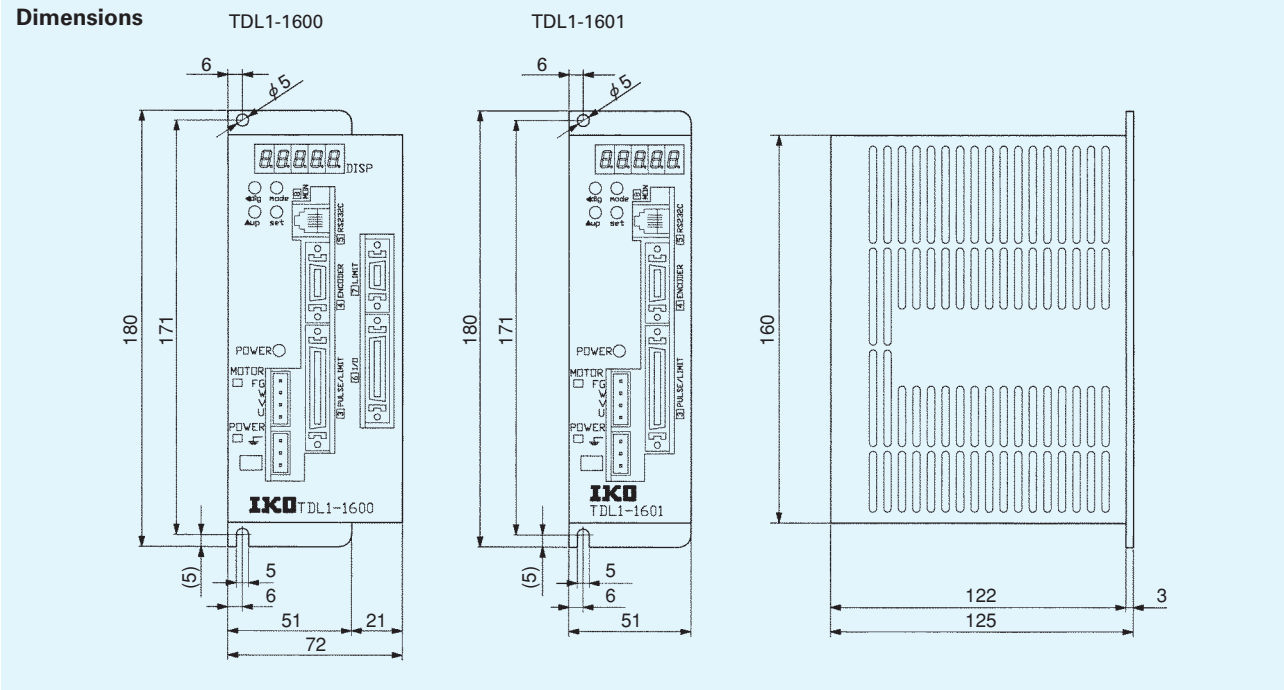
Drivers

Two types of drivers are available for Nano Linear NT. Both drivers can be controlled by a PC using the RS232C interface. When the optional mail box (automatic execution program area) is added, automatic operation using only the driver can be performed without applying extra load to the host side including the PC. If the user wants to use the mail box, contact IKO for further information.

In addition to the functions of the driver TDL1-1601, the driver TDL1-1600 can be connected to an external unit by sequence input/output and can configure a system using IKO Programmable Controller CTN.

Table 10 Specifications of drivers

Item	Model	TDL1-1600	TDL1-1601
Main power supply		AC85~110V 50/60Hz	
Continuous rated current		0.7A	
Instantaneous maximum current		4A	
Output limitation		Current feedback, overheat (motor and driver), thrust control, servo OFF, + direction movement disabled, and - direction movement disabled)	
PWM carrier frequency		40kHz	
Ambient temperature		0 to 40°C	
Temperature of heat radiation fin		70°C max (Overheat cut type)	
Command input		+direction/-direction pulse or position command pulse/direction command or A-phase/B-phase 10MHz max (2.5MHz for A-phase/B-phase)	Input by communication
Encoder input system		2-phase incremental encoder Line driver	
Response speed		1.5m/s max (at a resolution of 0.5 μm), 1.0m/s max (at a resolution of 0.1 μm)	
Sequence input		Servo ON, + direction movement disabled, - direction movement disabled, gain LOW, reset, and operation	Input by communication ⁽¹⁾
Origin signal output		Origin and pre-origin	— ⁽²⁾
Sequence output		Servo ready, completion of positioning, and alarm	Output by communication ⁽¹⁾
Parameter key		4 keys (digit selection, increment, data/parameter, and write)	
Data display		LED 7-segment 5-digit, output current/parameter/error code, etc.	
Parameter items (non-volatile memory)		Resolution, mode, electronic gear, gain, completion of positioning, electric origin, acceleration filter, etc.	
Analog monitor		2 channels (current speed and output current)	
Vibration and impact		Vibration 0.5G, impact 5G, once	
Mass (for reference)		1.2kg	1.0kg

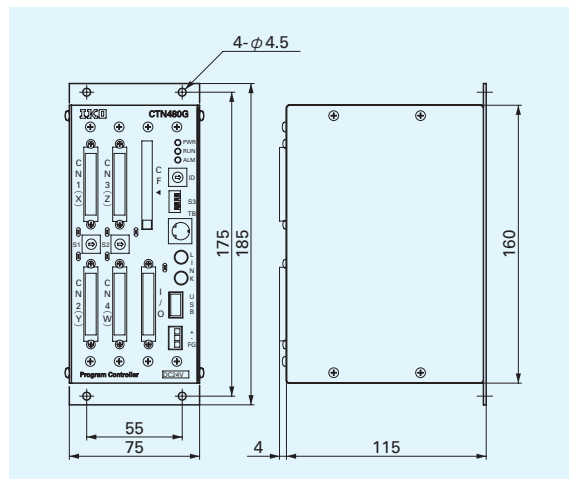


Note⁽¹⁾ : When requiring sequence inputs/outputs, contact IKO for further information.

⁽²⁾ : Return to the origin can be performed by communication.

1N=0.102kgf=0.2248lbs.
1mm=0.03937inch

Programmable Controller CTN480G (RoHS compliance)



- 1 Super-high-function type that permits program inputs up to 10000 steps
- 2 High-speed pulse output of up to 6M pps
- 3 The 4-axis linear interpolation/2-axis circular interpolation function is provided as standard.
- 4 Positional correction by linear encoder can be performed.
- 5 Program storage and transfer can be performed by CompactFlash
- 6 A system can be easily configured by using the incorporated I/O sequence function, timer, counter, and arithmetic function without using sequencers.
- 7 The USB interface is provided as standard. This permits data editing, controller operation and direct execution by PC.
- 8 A return-to-origin is not required because an absolute encoder is applicable.
- 9 Simultaneous execution/stop of optional axes can be performed by the synchronous control function.
- 10 Up to 5 programs can be simultaneously executed by the multi-task function.
- 11 Positioning accuracy correction can be performed by positioning correction data previously input.
- 12 Wiring with the driver can be easily performed by the input/output function for axes.
- 13 Up to 4 controllers (16-axis control) can be connected by link connection.

Table 11 Functions and performance

Item	Model	CTN480G
Command pulse output specifications	Number of control axes	4 axes (Simultaneous execution can be performed.)
	Maximum command value	±2147483648 pulses (signed 32-bit length)
	Maximum output frequency	6Mpps
	Acceleration/deceleration time	0 to 65.533 sec (straight line, cycloid, S-shaped acceleration/deceleration)
	Output method	CW/CCW direction pulse, direction command/normal/reverse pulse, 90° phase difference pulse
Program specifications	Input method	MDI, teaching, PC input by USB
	Command input method	Absolute command or incremental command
	Program capacity	10000 steps
Input/Output specifications	Functions	Jump, call, repetition, four operations, logical operations, speed setting, acceleration/deceleration setting, timer control, I/O control, input condition branch, various editing functions (create, erase, delete, insert, copy, etc.)
	Input	Number of input points
		LS input General-purpose input 16 points 20 points (The number can be extended up to 80 points.)
		Operation input
	Output	Start, stop, emergency stop, normal/reverse manual operation, return-to-origin, current position resetting, interrupt, completion of positioning, driver alarm input, etc. (Selection and allocation using parameters by general-purpose input)
		Input method
		Photo coupler input (for no-voltage contact or open collector)
Input/Output specifications	Output	Number of output points
		General-purpose input 20 points (The number can be extended up to 80 points.)
		Operation output
Input/Output specifications	Output	Auto operation status, limit sensor detection, emergency stop, pulse output status, completion of return-to-origin, servo ON, driver alarm resetting, proportional control, deviation counter clearing (Selection and allocation using parameters by general-purpose output)
		Output method
		Open collector output (DC30V 100mA MAX)
Power supply for inputs/outputs	For I/O	DC24V 4A
	For limit	DC24V 100mA
Other main functions		
USB (data read, write, direct execution, etc.) , program storage/transfer by compact flash, positional correction by linear scale, backlash correction, software limit, LS logical correction, check function (trace, I/O, LS, stop condition, etc.), 4-axis linear interpolation, 2-axis circular interpolation		

Remarks : 1. The model number of the dedicated teaching box (separately available) is TAE10M5-TB.
 2. Cable for USB connection shall be prepared by customer. Connector A-A type is necessary. (Refer to Fig.8)
 3. Compact Flash (Type I) shall be prepared by customer. (Refer Fig.9)
 4. CompactFlash is a registered trademark of SanDisk Corporation.

Table 12 General specifications

Item	Model	CTN480G
Supply voltage		DC24V±10%
Maximum current consumption		4.5A
Ambient temperature		0 to 50°C
Ambient humidity		Storage : -10 to 60°C 20 to 85%RH (Keep dewdrop free)
Counter measure for outage		Flash memory
Mass (Ref.)		1.2kg

Table 13 Accessories

Type	Model	Remark
I/O connector	10150-3000PE (plug)	Sumitomo 3M
	10350-52Y0-008 (cover)	
Power connector	XW4B-03B1-H1	Omron Corp. (Two pieces)
Link connector	4832.1310 (2 pieces)	Schurter AG
	CFS1/4C101J	KOA Corporation
DIN rail mounting part	DRT-1	Takachi Electric Industrial Co., Ltd.

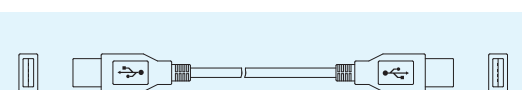


Fig.8 USB cable (A-A type connector)

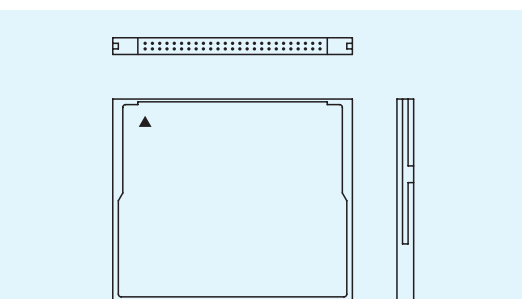


Fig.9 CompactFlash (Type I)

Thrust and Dynamic Load Mass

What is Thrust?

Thrust is a force in the moving direction exercised by the moving coil as shown in the figure (page 3) illustrating the Principle of Operation.

Thrust becomes maximum when the table is at rest, and decreases as the table speed increases.

For the thrust required for acceleration or deceleration, see the graph of thrust characteristics on page 8 or 16.

What is Effective Thrust?

Effective thrust is the effective value of the thrust required in a given operation pattern.

When this value exceeds the rated thrust of Nano Linear NT, the motor may be overheated or seized. When using this model, calculate the effective thrust and operate within it. However, the operation limit may vary according to the operating conditions, etc.

In general, the effective thrust (F_{rms}) is obtained as follows. (For a calculation example, see page 21.)

$$F_{rms} = \sqrt{\frac{F_P^2 \times t_a + (F_P - 2 \times F_L)^2 \times t_b + F_L^2 \times t_c}{t}}$$

Where, F_P is the force required for acceleration.

F_L is the force due to running resistance.

The running resistance consists of the friction of the linear motion rolling guide incorporated in Nano Linear NT, the attracting force of a magnet, etc.

What is Dynamic Load Mass?

The dynamic load mass is the maximum weight that permits obtaining the required acceleration and deceleration. The acceleration or deceleration on Nano Linear NT becomes smaller as the weight on the table increases. Therefore, when using this model, examine the operation pattern taking the relationship between the weight and acceleration/deceleration into consideration.

The graph (page 8 or 16) of dynamic load mass is based on the thrust that can be obtained by Nano Linear NT at the speed of 500mm/s. For example, the acceleration/deceleration under the loaded weight of 1kg is about 15m/s² max in case of NT60.

Examination Example of Operation Pattern

■Calculation of acceleration/deceleration time

The thrust required for driving Nano Linear NT reaches its peak during acceleration.

The thrust required during acceleration is limited by the thrust of Nano Linear NT. The limit acceleration time is therefore calculated by the following formula.

• Force due to acceleration F_a

$$F_a = (W_L + W_T) \frac{V}{t_a} \text{ [N]}$$

• Thrust required for acceleration F_P

$$F_P = F_a + F_L \text{ [N]}$$

• Limit acceleration time t_a

$$t_a = \frac{(W_L + W_T) V \times k}{F_M - F_L} \text{ [s]}$$

where,

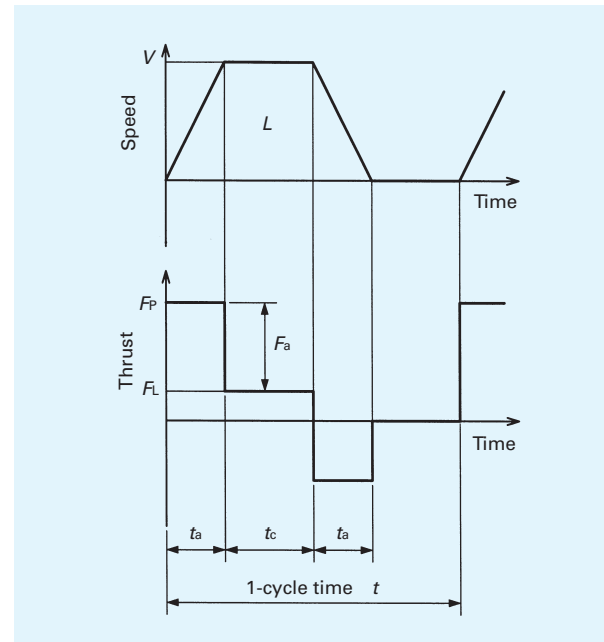
W_L : Load mass kg
 W_T : Mass of the moving part kg
 t_a : Acceleration time s
 V : Moving speed m/s
 k : Safety factor (1.3)

■Examining the possibility of operation

When Nano Linear NT is operated when the effective thrust exceeds the rated thrust value, motor may be overheated, failure and could cause injury. Even if the effective thrust does not exceed the rated thrust value, motor overheating may be caused from the heat release conditions, etc.

Calculate the effective thrust of the operation pattern in advance to examine whether the desired operation can be safely performed or not.

An examination example of an operation pattern is shown below. The following operation pattern is temporarily set in consideration of the travel distance, load mass, acceleration time from the specifications, performance, and characteristics described on page 8 or 16.



Setting items

Specifications of table	Model		NT80V65	
	Mass of the moving part	W_T	0.28	kg
	Thrust at the moving speed of V	F_M	32	N
	Running resistance Calculated by the fixed value shown at right.	F_L	1.5	N
Operation pattern	Load mass	W_L	0.5	kg
	Travel distance	L	0.06	m
	Moving speed	V	0.5	m/s
	Time	t_a	0.04	s
		t_c	0.08	s
		t	0.5	s
	Safety factor	k	1.3	

STEP 1. Calculation of the thrust required for acceleration (deceleration)

① Force due to acceleration F_a

$$F_a = (W_L + W_T) \frac{V}{t_a}$$

$$= (0.5 + 0.28) \times \frac{0.5}{0.04} \div 9.8 \text{ [N]}$$

② Thrust required for acceleration F_P

$$F_P = F_a + F_L$$

$$= 9.8 + 1.5 = 11.3 \text{ [N]}$$

Make sure that $F_P \times k$ (safety factor) does not exceed the thrust provided at the moving speed of V . If this value exceeds F_M re-examine the maximum speed, acceleration (deceleration) time, and other factors of the operation pattern.

$$F_P \times k = 11.3 \times 1.3 \div 14.7 \text{ [N]} < F_M (32\text{N})$$

In this example pattern, it can be judged that the acceleration operation can be performed.

STEP 2. Calculation of effective thrust

Effective thrust F_{rms} can be determined as follows.

$$F_{rms} = \sqrt{\frac{F_P^2 \times t_a + (F_P - 2 \times F_L)^2 \times t_a + F_L^2 \times t_c}{t}}$$

$$= \sqrt{\frac{11.3^2 \times 0.04 + (11.3 - 2 \times 1.5)^2 \times 0.04 + 1.5^2 \times 0.08}{0.5}}$$

$$\div 4 \text{ [N]}$$

Make sure that F_{rms} does not exceed the rated thrust. If F_{rms} exceeds rated thrust, re-examine the maximum speed, acceleration (deceleration) time, and other factors of the operation pattern.

In this example pattern, $F_{rms} (4\text{N}) < 8\text{N}$ (rated thrust). Accordingly, it can be judged that a continuous operation is possible.

Before using Nano Linear NT, make sure that the temperature of the table in the actual machine is below 50°C. This temperature may be exceeded depending on the ambient temperature and heat release conditions even if the effective thrust does not exceed the rated thrust as the result of calculation. If the temperature is high, take a heat release measure or re-examine the operation pattern.

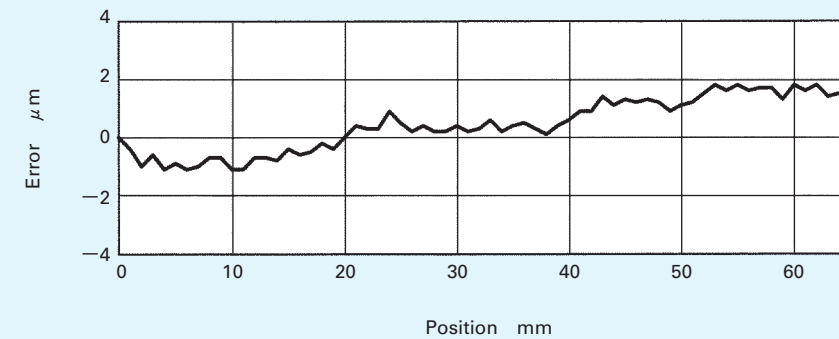
Cautions in Use

- ◆ Nano Linear NT is a precision device. Therefore, handle it with great care and do not apply any excessive load or strong impact on it.
- ◆ Design the system that does not apply excessive force to cables.
- ◆ Use this product in a clean environment free from water, oil, dust and other foreign matters.
- ◆ Make sure that the mounting base is free from dirt and harmful protuberances.
- ◆ The flatness of the mounting base for Nano Linear NT will affect the positioning accuracy. It must be less than 10μm.
- ◆ Nano Linear NT contains strong magnets. If a ferromagnetic body is placed close to Nano Linear NT, this may be attracted.
- ◆ The magnetic circuit inside Nano Linear NT is a closed circuit. However, a slight magnetic flux leak exists and may affect devices sensitive to magnetism located in the neighborhood. In such instances, please contact IKO.
- ◆ The linear motion rolling guide assembled in Nano Linear NT is lubricated with grease. So take extreme care not to allow dirt or any foreign matters to enter into the unit.
- ◆ Nano Linear NT is machined, assembled and adjusted with high accuracy. Accordingly, never disassemble or remodel it in any case.
- ◆ If using Nano Linear vertically, consult IKO before designing.

©The appearance, specifications and other details of the products are subject to change without prior notice for improvement.

Examples of Measured Data

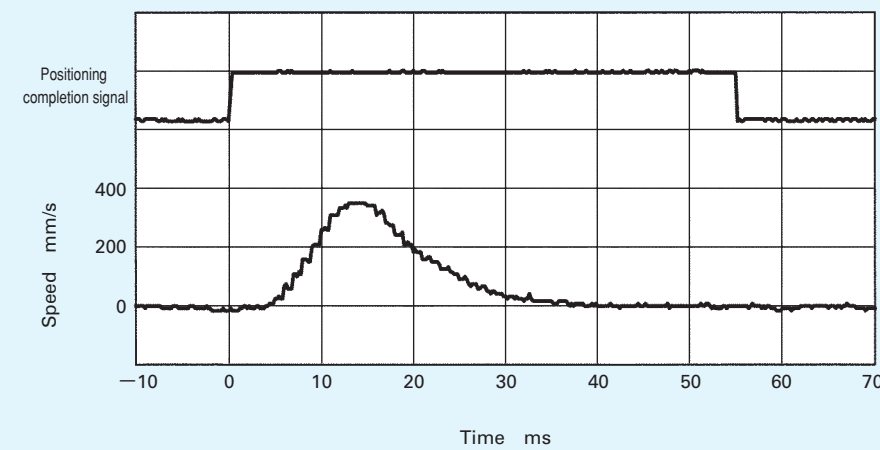
●Positioning accuracy



Measuring conditions

Load mass : 750g
 Measuring position : 35mm
 (from the top surface of the table)
 Room temperature : 20°C
 Sample : NT60-65

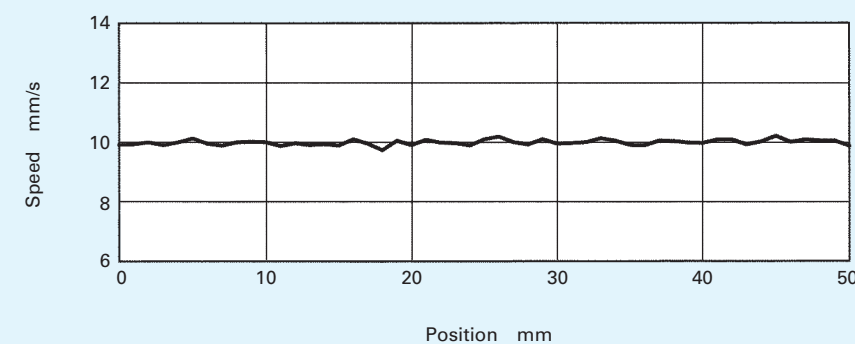
●Positioning time



Measuring conditions

Load mass : 100g
 Travel amount : 5mm
 Setting width : $\pm 1 \mu\text{m}$
 Sample : NT60-65

●Speed stability



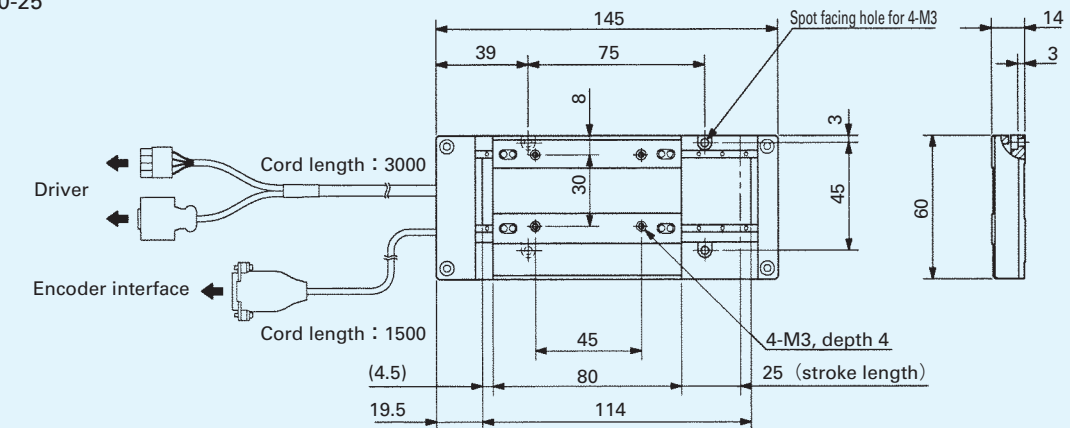
Measuring conditions

Load mass : 750g
 Moving speed : 10mm/s
 Sample : NT60-65

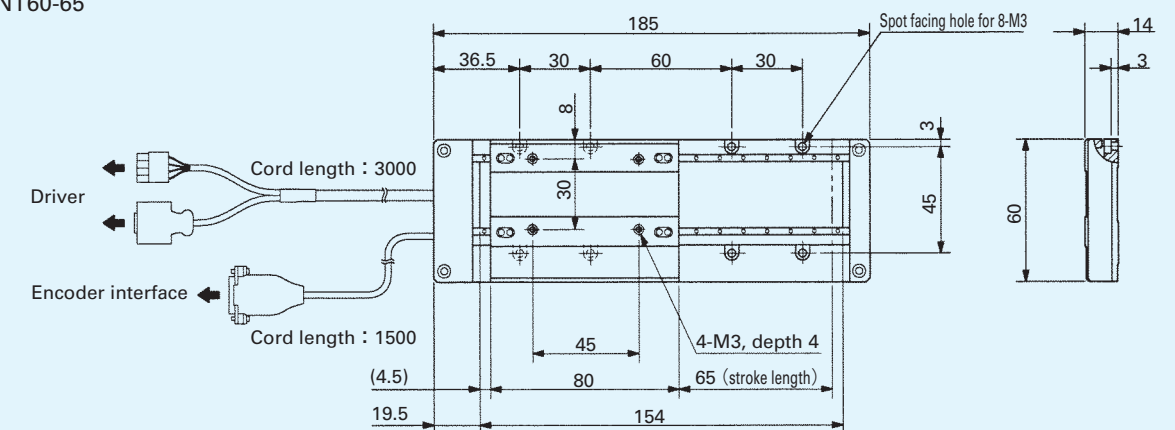
Nano Linear NT

NT

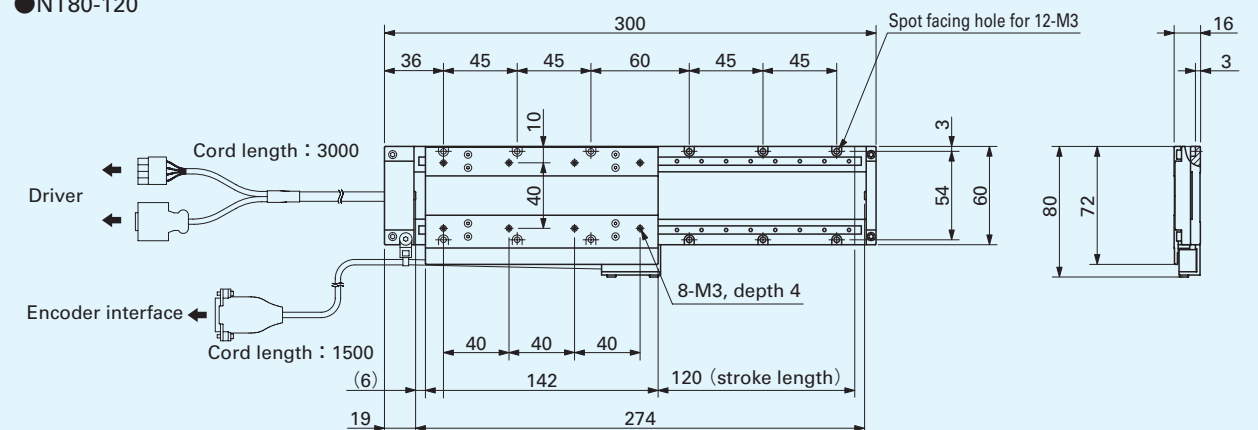
●NT60-25



●NT60-65



●NT80-120



Between NT.../A and NT.../B, there is a difference in connector specification for driver connection.

1N=0.102kgf=0.2248lbs.
 1mm=0.03937inch

World Network of IKO



NIPPON THOMPSON CO., LTD.

Head office : 19-19 Takanawa 2-chome Minato-ku
Tokyo 108-8586, Japan
Phone : +81 (0)3-3448-5850
Fax : +81 (0)3-3447-7637
E-mail : ntt@ikonet.co.jp
URL : <http://www.ikont.co.jp/eg/>
Plant : Gifu, Kamakura

NIPPON THOMPSON CO., LTD.

ASEAN REPRESENTATIVE OFFICE
Level 8, #1 Silom Road, Silom
Bangrak, Bangkok
Thailand 10500
Phone: +66 (0)-2-231-8278
Fax: +66 (0)-2-231-8121
E-mail: ntar@ikonet.co.jp

IKO-THOMPSON (SHANGHAI) LTD.

Unit G, 23rd Floor, Zhao Feng World Trade Building
No.369, Jiang Su Road
Changning District, Shanghai 200050
People's Republic of China
Phone: +86 (0)21-5237-9100
Fax: +86 (0)21-5237-9095
E-mail: ntc@ikonet.co.jp

IKO INTERNATIONAL, INC.

<http://www.ikont.com/>

East coast

91 Walsh Drive
Parsippany, NJ 07054
U.S.A.
Phone: +1 973-402-0254
Toll Free: 1-800-922-0337
Fax: +1 973-402-0441
E-mail: eco@ikonet.co.jp

Midwest

500 East Thorndale Avenue
Wood Dale, IL 60191
U.S.A.
Phone: +1 630-766-6464
Toll Free: 1-800-323-6694
Fax: +1 630-766-6869
E-mail: mwo@ikonet.co.jp

West coast

20170 South Western Avenue
Torrance, CA 90501
U.S.A.
Phone: +1 310-609-3988
Toll Free: 1-800-252-3665
Fax: +1 310-609-3916
E-mail: wco@ikonet.co.jp

Southeast

2150 Boggs Road, Suite 100
Duluth, GA 30096
U.S.A.
Phone: +1 770-418-1904
Toll Free: 1-800-874-6445
Fax: +1 770-418-9403
E-mail: seo@ikonet.co.jp

Southwest

8105 N. Beltline Road
Suite 130, Irving, TX 75063
U.S.A.
Phone: +1 972-929-1515
Toll Free: 1-800-295-7886
Fax: +1 972-915-0060
E-mail: swo@ikonet.co.jp

NIPPON THOMPSON EUROPE B.V.

<http://www.ikont.eu/>

The Netherlands

Sheffieldstraat 35-39
3047 AN Rotterdam
The Netherlands
Phone: +31 (0)10-4626868
Fax: +31 (0)10-4626099
E-mail: nte@ikonet.co.jp

Germany

Mündelheimer Weg 56
40472 Düsseldorf
Germany
Phone: +49 (0)211-414061
Fax: +49 (0)211-427693
E-mail: ntd@ikonet.co.jp

Im Gewerbepark D 30
93059 Regensburg
Germany
Phone: +49 (0)941-206070
Fax: +49 (0)941-2060719
E-mail: ntdr@iko-nt.de

Gruben Str.95c
66540 Neunkirchen
Germany
Phone: +49 (0)6821-999-860
Fax: +49 (0)6821-999-8626
E-mail: ntdn@iko-nt.de

UK

2 Vincent Avenue, Crownhill
Milton Keynes Bucks MK8 0AB
United Kingdom
Phone: +44 (0)1908-566144
Fax: +44 (0)1908-565458
E-mail: sales@iko.co.uk

Spain

Autovia Madrid-Barcelona, Km. 43,700
Polig. Ind. AIDA, A-8, Ofic. 2, 1^a
19200-Azuqueca de Henares
Guadalajara, Spain
Phone: +34 949-263390
Fax: +34 949-263113
E-mail: nts@ikonet.co.jp

France

Roissypole Le Dôme
2 rue de La Haye
BP 15950 Tremblay en France
95733 Roissy C. D. G. Cedex
France
Phone: +33 (0)1-48165739
Fax: +33 (0)1-48165746
E-mail: ntf@ikonet.co.jp

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**ISO 9001 & 14001 Quality system
registration certificate**

