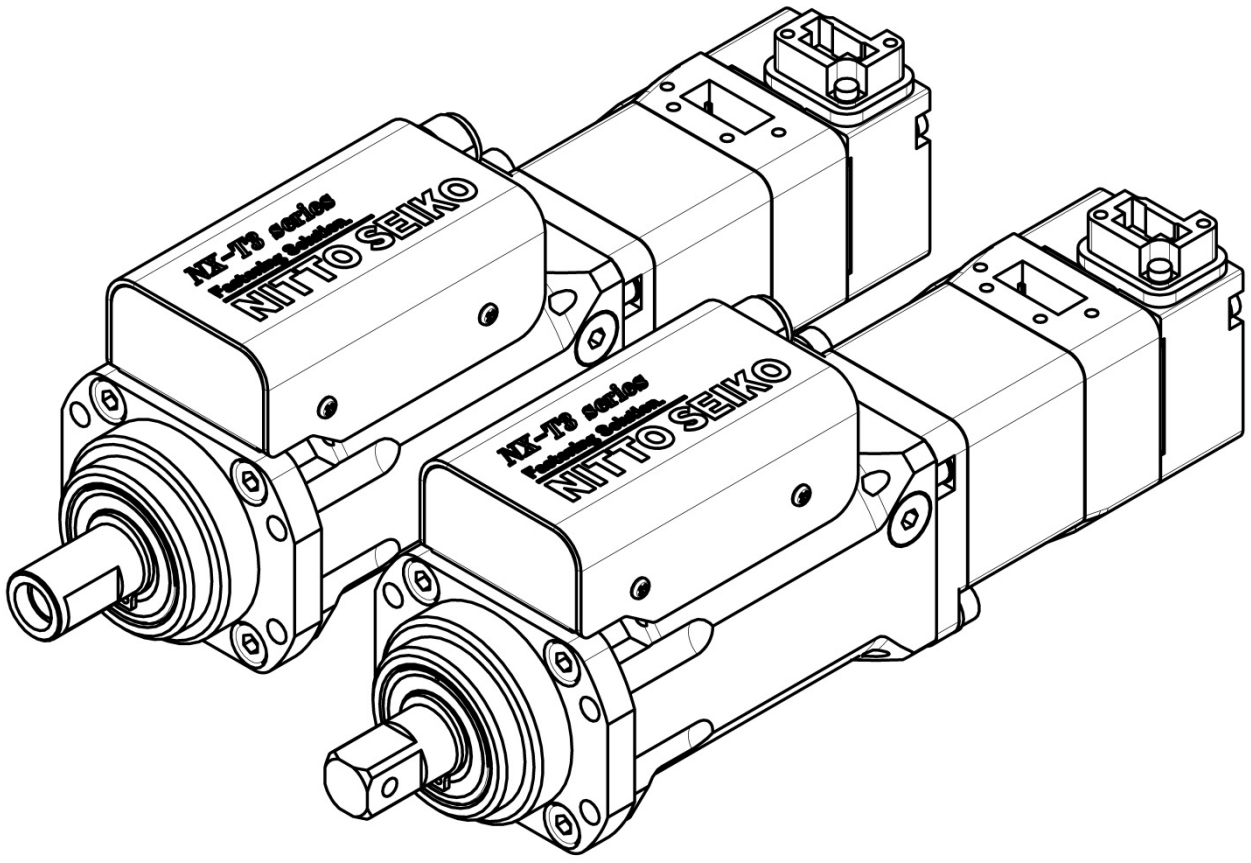
NX-T3 series (for SD600T)

NX driver tool unit

Instruction manual Ver. 1.00



NITTO SEIKO CO.,LTD.

Update: Jul. 7, 2017

Introduction

Thank you for purchasing an NX driver T3 series product. The NX driver T3 series is a product that consists of a tool unit and a controller (SD600T) and serves as a high-performance, high-functionality driver using an AC servomotor.

Read this instruction manual carefully to ensure that the NX driver T3 series product will be used correctly over an extended period of time.

Please observe the following:

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- If this instruction manual is provided as electronic media, the user is assumed to agree with the contents of readme.txt contained in the media.
- The contents of this document may be changed without prior notice due to product specification changes or for some other reason.
- Product names and other specific names in this document are registered trademarks or trademarks of their respective companies.
- In the figures of this manual, the products may be shown without the covers and safety shielding materials for the ease of explanation on detailed parts. When you operate a product, make sure specified covers and shielding materials on and follow this instruction manual.
- Typical examples are shown in this manual and may differ from the system delivered to the customer.
- Please contact our agent or our closest branch if an additional copy of this instruction manual is needed.
- Any modifications to this product by the customer shall be beyond the scope of our warranty. Nitto Seiko shall not take any responsibility for any damage resulting from its products modified by customers.

The instructions for use:

- The final fastening torque value might change depending on the rotational speed of the driver or the inertia of the joint mounted on the output shaft, or for some other reason. Set the torque value and rotational speed to appropriate values according to the instruction manual.
- Each tool unit model uses different parameters (motor characteristic values). When connecting a tool unit and the SD600T controller, always specify appropriate parameter values according to the instruction manual. If an incorrect value is specified, the tool unit or the controller may be damaged.

Tool units covered by this Instruction manual

- NX020T3-07M*-20
- NX050T3-07M*-20
- NX100T3-07M*-20
- NX020T3-07S*-20
- NX050T3-07S*-20
- NX100T3-07S*-20

Contents

For safe usage

When using this product (for installation, operation, maintenance, and inspection), be sure to understand the meaning of the following precautions and handle it correctly with much care for safety.
It is difficult to state clearly all items regarding safety in this manual. Therefore, be aware that accurate judgment about safety by persons handling this product is very important to avoid a risk.

DANGER	Indicates that incorrect handling may lead to an imminent injury accident (death or serious injury).
WARNING	Indicates that incorrect handling may lead to an injury accident (death or serious injury).
CAUTION	Indicates that incorrect handling may lead to an injury, physical damage, or machine operation failure.

Even the following items covered by “CAUTION” may lead to a serious accident depending on circumstances. All the items are important. Be sure to follow the precautions:

Meanings of signs

(Example of sign)

INDICATES WHAT SHOULD BE TAKEN CARE OF.

INDICATES WHAT MUST NOT BE DONE.

INDICATES WHAT MUST BE DONE.

DANGER

- **Be sure to establish a ground.**

  Be sure to connect a ground terminal to the ground pole (Class D ground). Otherwise, an electric shock or fire may occur.

WARNING

- **Don't touch rotating part.**

  During operation, don't touch rotating part of a driver.
  Otherwise, you may be injured.

- **Turn off power when an abnormal symptom is exhibited.**

  When an abnormal symptom is exhibited, such as smoke emission or bad smell, turn off the power and contact our agent or sales office to ask for repair.
  If the product is used without repair, a fire or electric shock accident may occur.

⚠ WARNING

- **Don't use a voltage other than specified.**

  Don't use the driver with a voltage other than specified. Otherwise, a fire, electric shock, or failure may occur.

- **Don't touch a part inside the controller.**

  Don't touch a part inside the controller. Otherwise, an electric shock or failure may occur.

- **Don't use the product in a place with much humidity, greasy fumes, or dust.**

  Don't use the product in a place where water is splashed, in a corrosive atmosphere, in a flammable gas atmosphere, and near a flammable substance. Otherwise, a fire, electric shock, or failure may occur.

- **Don't damage a cable.**

  Don't place a heavy object on, pull forcefully, or twist a cable.
  Otherwise, a cable may be broken, causing a fire, electric shock, accident, or failure.

- **Don't disassemble or modify the product.**

  Otherwise, a fire, electric shock, accident, or failure may occur.

⚠ CAUTION

- **Use a tool with a specified setting.**

  Since a parameter setting of a controller may vary depending on a tool unit, use the controller after configuring settings as specified. Otherwise, a fire or failure may occur.

- **Don't obstruct the ventilation hole of the controller.**

  Otherwise, heat is kept inside, and a fire or failure may occur.

- **Don't change wiring while power is turned on.**

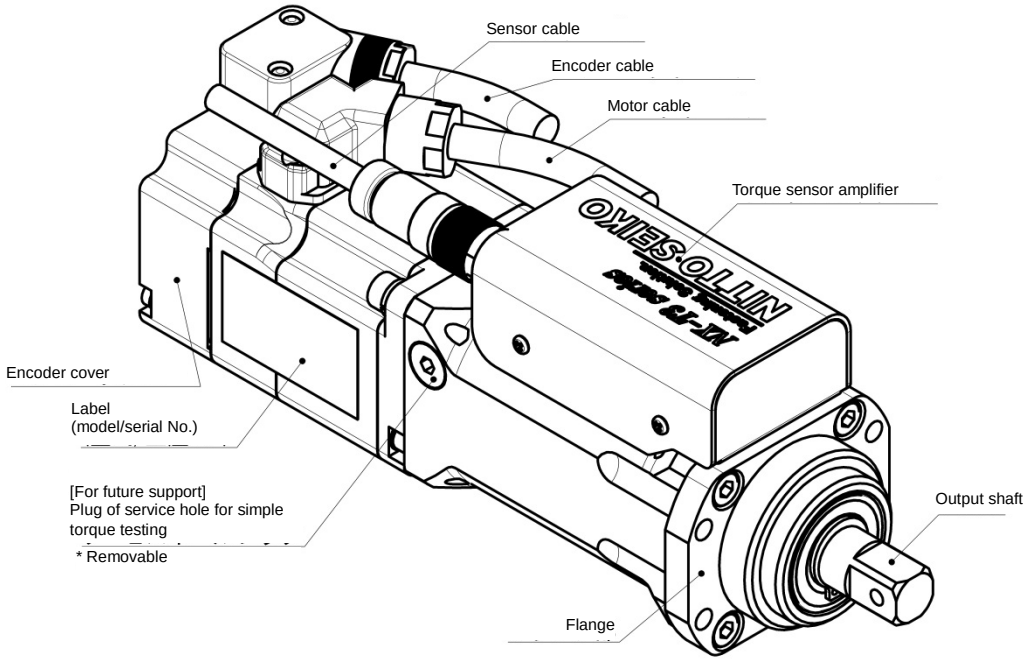
  Otherwise, an electric shock or failure may occur.

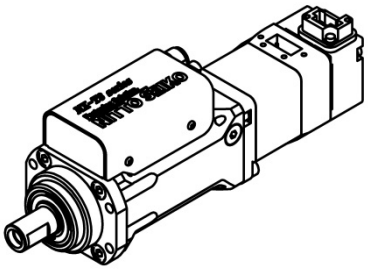
- **Fix each unit securely.**

  Fix a tool unit and controller securely before using.
  Otherwise, injury or failure may occur.

Preparation of driver

1. Part names



External view of tool unit	Type	Model
	NX020T3 NX050T3 NX100T3	○ Nominal output torque 020 2N·m 050 5N·m 100 9N·m ○ Output shaft M M8 × 1.25 S □9.5mm NX □ T3−07 □ ∗−20 Series name The * part of the model indicates our control number.

2. Inspection on receipt of product

When you receive a NX driver T3 series product, check and inspect it as follows:

Check/inspection item	Remarks
[1] Is the product what you have ordered?	Check it with the “Model” shown on the labels of the tool unit and the controller.
[2] Does the output shaft of the tool unit rotate smoothly?	It’s OK if you can manually rotate the output shaft smoothly.
[3] Is there any broken part?	Check for any damage caused during transportation etc. by viewing its appearance.
[4] Is there any tightened part, such as a screw, that comes loose?	Make a check with a tool, such as a wrench, as necessary.

If you find any problem mentioned above, contact the agent you have purchased from or our sales office immediately.

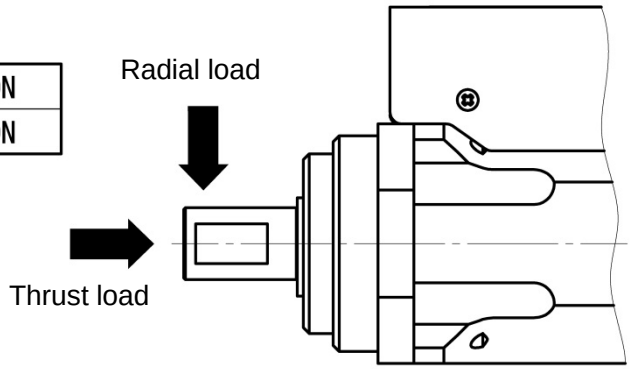
3. Notes on mounting the tool unit

(1) Don’t give a shock to the motor in the tool unit. Otherwise, a failure may occur.

(2) Don’t pull a cable (encoder, motor power supply) of the tool unit. Otherwise, it may be broken. Be sure to fix the cable when installing the tool unit.

(3) Don’t give a strong shock to or place a load on the output shaft of the tool unit. Otherwise, a failure may occur.
(Allowable loads are as follows.)

Allowable radial load	200N
Allowable thrust load	200N



(Caution) If the tool unit is used near the maximum allowable load shown above, torque accuracy could be affected.

(4) The tool unit is designed to be used indoors. Use it under the following environment.

- **Indoor environment free from corrosive and explosive gas**
- **Well-ventilated, and free from dust and humidity**
- **Ambient temperature range: 0–40°C**
- **Humidity range: 20–80%RH without condensation**
- **1000 m less or equal above sea level.**
- **Environment enabling easy inspection and cleaning**
- **Locations free from strong electric or magnetic field**
- **Locations in which atmosphere is free from conductive powders including iron powder**
- **Locations free from excessive vibration or impact**

4. Cable connection

Connect a motor cable, an encoder cable, and a sensor cable to the tool unit as shown in the drawing below. (For connection at the controller, refer to a separate document “Driver controller SD600T Instruction manual”.)

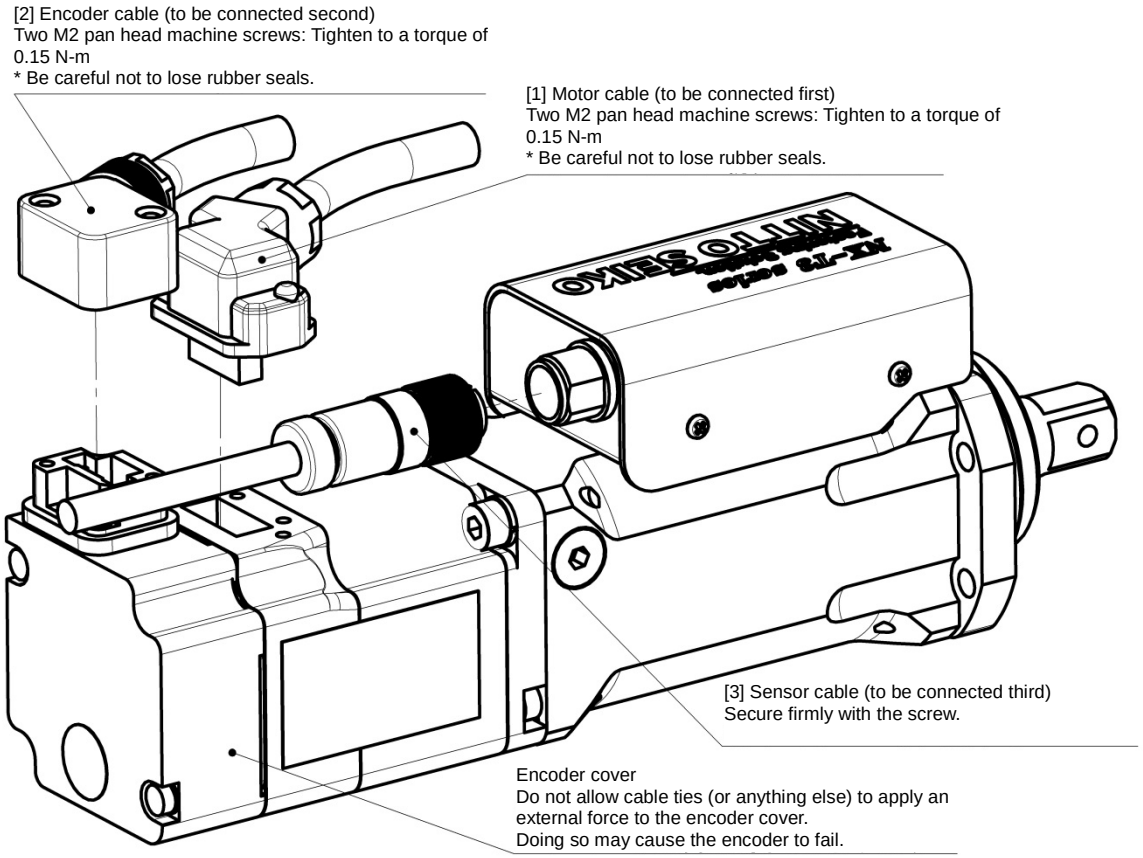
Connect each cable in the order shown below.

When connecting a cable, always grip the connector of the cable.

[1] Connecting the motor cable
Secure the connector with the two M2 pan head machine screws (provided with the connector). Tighten the screws securely to a torque of 0.15 N-m and check that the connector is not loose. Be careful not to lose rubber seals.

[2] Connecting the encoder cable
Secure the connector with the two M2 pan head machine screws (provided with the connector). Tighten the screws securely to a torque of 0.15 N-m and check that the connector is not loose. Be careful not to lose rubber seals.

[3] Connecting the sensor cable
Secure the cable by rotating the knurled section of the screw. Turn the screw into the thread properly and check that the screw is not loose.



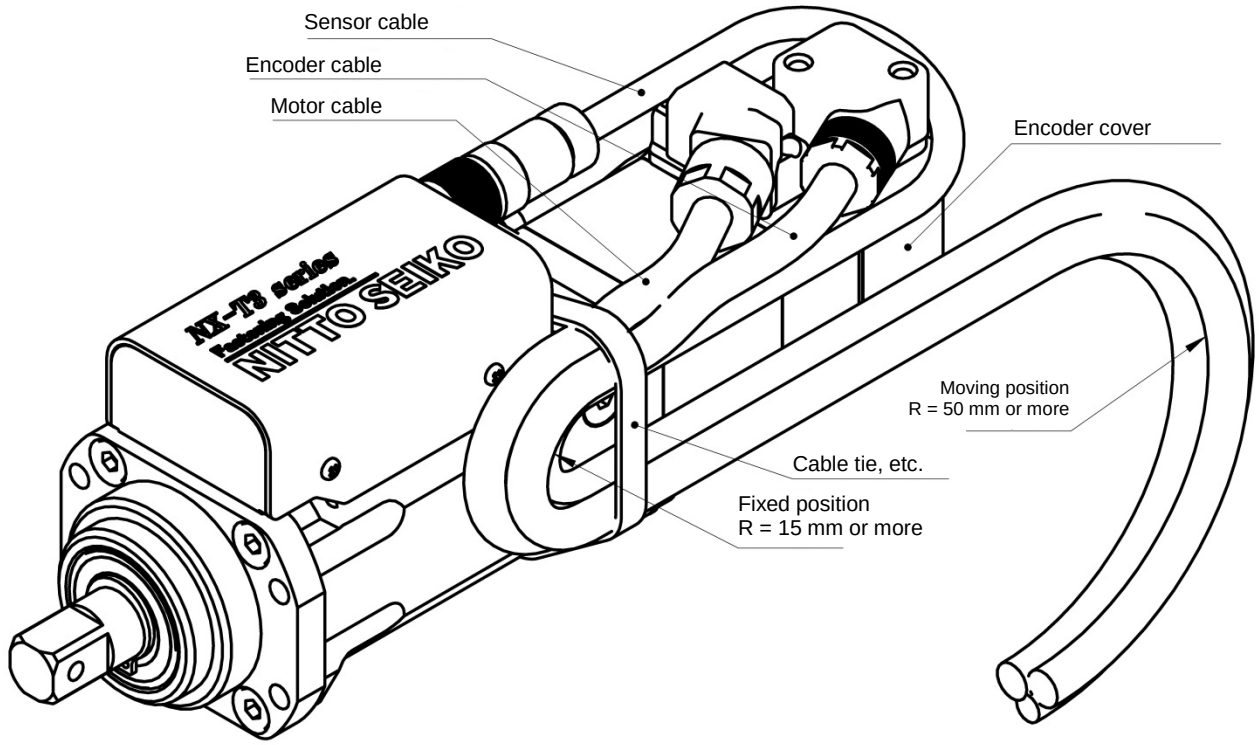
(Caution) The NX driver is a single shaft control type. Therefore, when using multiple shafts, take care to avoid incorrect wiring between the tool unit and the controller. Failure to do so may result in damage to the torque sensor, motor burnout, or other problems.

5. Routing the cables

Secure the motor cable, encoder cable, and sensor cable with cable ties (or other similar materials) near the center of the tool unit as shown in the figure below **in order to prevent forces from being imposed directly onto the connectors when the cables are pulled.**

Note the following points during wiring:

- Route the cables so that excessive force is not applied to the connectors.
- Ensure that the bend radius (R) of each cable is **at least 15 mm (at fixed positions)** and **at least 50 mm (at moving positions).**
- Do not allow cable ties, cables, or other materials to apply external forces to the encoder cover. Doing so may cause the encoder to fail.



6. Parameter setting

The parameters referred to here are the setting values indicating the characteristics of the tool unit. The parameters vary depending on the combination of the tool unit and a controller.
Before shipping, parameters are factory-set according to the tool unit model. However, should the driver fail to operate properly, check the parameters in the following table. If any parameter values differ from those shown in the table, immediately contact the dealer from which you purchased the product, or your local Nitto Seiko branch office.

Tool unit model / Parameter Number	NX020T3	NX050T3	NX100T3
Pa 18 (LP018)	0220	0300	0330
Pa 19 (LP019)	2400	6000	1080
Pa 30 (LP030)	0500	1000	1000
Pa 31 (LP031)	0500	1000	1000
Pa 35 (LP035)	0800	1500	1500
Pa 36 (LP036)	0800	1500	1500
Pa 40 (LP040)	0700	0400	0300
Pa 41 (LP041)	0700	0400	0300
Pa 60 (LP060)	0078	0078	0078
Pa 61 (LP061)	0011	0011	0011
Pa 67 (LP067)	6100	6100	7100
Pa 68 (LP061)	0100	0100	0100
Pa 106 (LP106)	0000	0000	0000
Pa 114 (LP114)	0003	0003	0005
Pa 120 (LP120)	0009	0009	0009
Pa 121 (LP121)	0005	0005	0005
Pa 122 (LP122)	0465	0375	0186
Pa 123 (LP123)	0124	0157	0136
Pa 124 (LP124)	0383	0598	0605
Pa 125 (LP125)	0843	1794	1997
Pa 134 (LP134)	0000	0000	0000
Compatible controller	SD600T03-2020-*		SD600T 05-2020-*

- The numeric values in parentheses in the parameter number column indicate the display of the controller.
- The * part of the compatible controller model indicates our control number.

(Caution) Connecting incompatible models by mistake could damage the tool unit or controller, so take care when connecting a tool unit and controller.

♦ How to set parameter

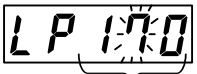
Set parameters as follows:
(For more information on each parameter, refer to a separate document “Parameter list”.)

(Display on the controller)

[1] Press the ENT key once to switch the monitor (or settings) display to the mode display.

[2] Press the MODE key several times to switch to “LP000” (parameter mode).

[3] Press the → key to move the blinking digit to the digit to be set, and then press the ↑ key or ↓ key to change to the parameter number to be edited.

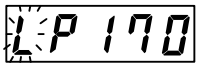


Change these three digits

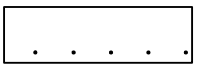
[4] Pressing the ENT key displays the value of the parameter.

[5] Press the → key to move the blinking digit to the digit to be set, and then press the ↑ key or ↓ key to change to a desired value.

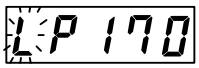
[6] When the value has been changed, press the ENT key once to switch to the mode display. Check that the blinking digit is located at the highest-order digit “L”.



[7] Save the changed value to the controller.
Keep pressing the ← key until all the digits change to dots (.).
(Releasing the key returns the display to the original state.)



[8] This completes the procedure for editing one parameter. To edit another parameter, repeat steps [1] through to [7].
When all changes have been completed, turn the power off temporarily, make sure that the display on the screen has disappeared, and then turn the power on again.



(Caution) Parameter values that have been changed do not take effect until the power is turned off.
The values shown on the controller display are just an example. So, actual values may be different.

7. Torque and rotational speed settings

Before shipping, torque and rotational speed settings are factory-adjusted according to the customer's specifications. However, if necessary, change the settings as described below.

The NX driver uses "two-step fastening" consisting of two processes ("initial rundown" and "final fastening") as the basic screw fastening method. First, the driver performs initial rundown at high speed from when fastening starts until a screw is seated. After the screw is seated, the driver performs final fastening at low speed to satisfy both fastening speed and torque accuracy.
A key point of reducing "tact time" is to rotate the shaft as fast as possible during initial rundown, but if **the momentary torque (hereafter referred to as "impact torque") that is generated by the inertia (a property of the output shaft by which it continues revolving) of the rotating system when a screw is seated** is higher than the target torque value, fastening cannot be performed normally.
Use the following procedure to specify appropriate torque and rotational speed settings.

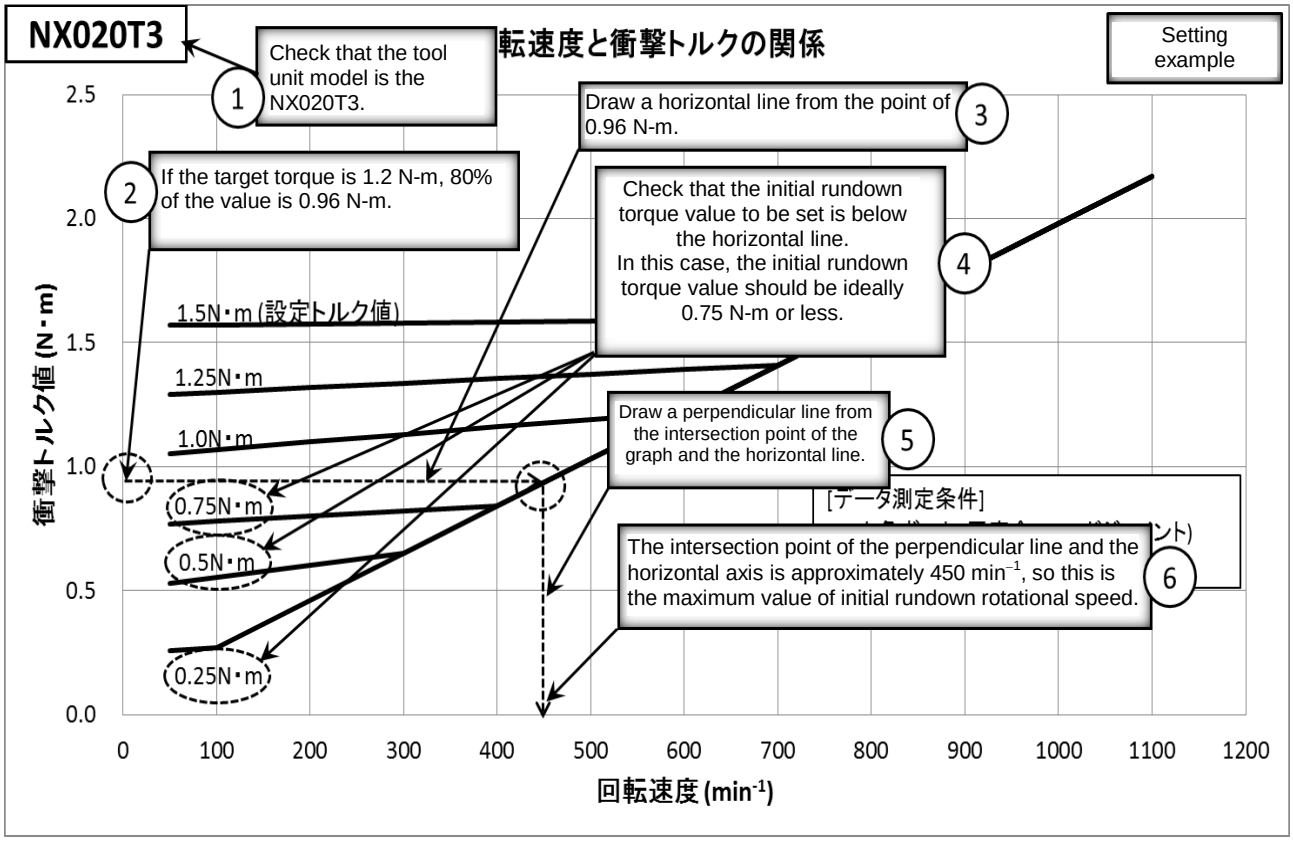
(1) Setting the final fastening torque
Specify the final target torque as the final fastening torque.

(2) Setting the final fastening rotational speed
Lowering the final fastening rotational speed makes the revolutions more stable, but if the speed is too low, revolutions might become uneven, resulting in unstable torque. **We recommend that the final fastening rotational speed be 10 min^{-1} for the standard torque-measured fastening method or 30 min^{-1} for the torque-controlled fastening method.**

(3) Setting the initial rundown torque
Normally, the initial rundown torque for machine screws should be as low as possible. For self-tapping screws or other screws that require torque, the initial rundown torque should be as low as possible, provided that the screw can be seated stably.
However, the initial rundown torque must be 0.25 N-m or higher for the NX020T3 or 0.5 N-m or higher for the NX050T3 and NX100T3.

(4) Setting the initial rundown rotational speed
The initial rundown rotational speed should be as high as possible, but if the rotational speed is too high, the impact torque will exceed the target torque, preventing normal fastening. Specify the initial rundown rotational speed **so that the impact torque is no more than 80% of the target torque.**
Impact torque can be calculated by referring to "Relationship between rotational speed and impact torque" on pages 10 to 12.
Use the following procedure to make calculations by referring to the graph corresponding to the tool unit model.
[How to calculate initial rundown rotational speed]
[1] Check that the graph to be used matches the tool unit model.
[2] Calculate a torque value that is 80% of the target torque.
[3] Treat the torque value in [2] as the impact torque value and draw a horizontal line from the torque value on the vertical axis on the left side.
[4] Check that the initial rundown torque value to be set is below the horizontal line.
[5] Draw a perpendicular line from the intersection point of the graph and the horizontal line.
[6] The intersection point of the perpendicular line and the horizontal axis is the maximum value of initial rundown rotational speed.

[Setting example]
As an example, calculate the initial rundown rotational speed under the following conditions:
Tool unit model: NX020T3
Screw type: Machine screw
Target torque: 1.2 N-m



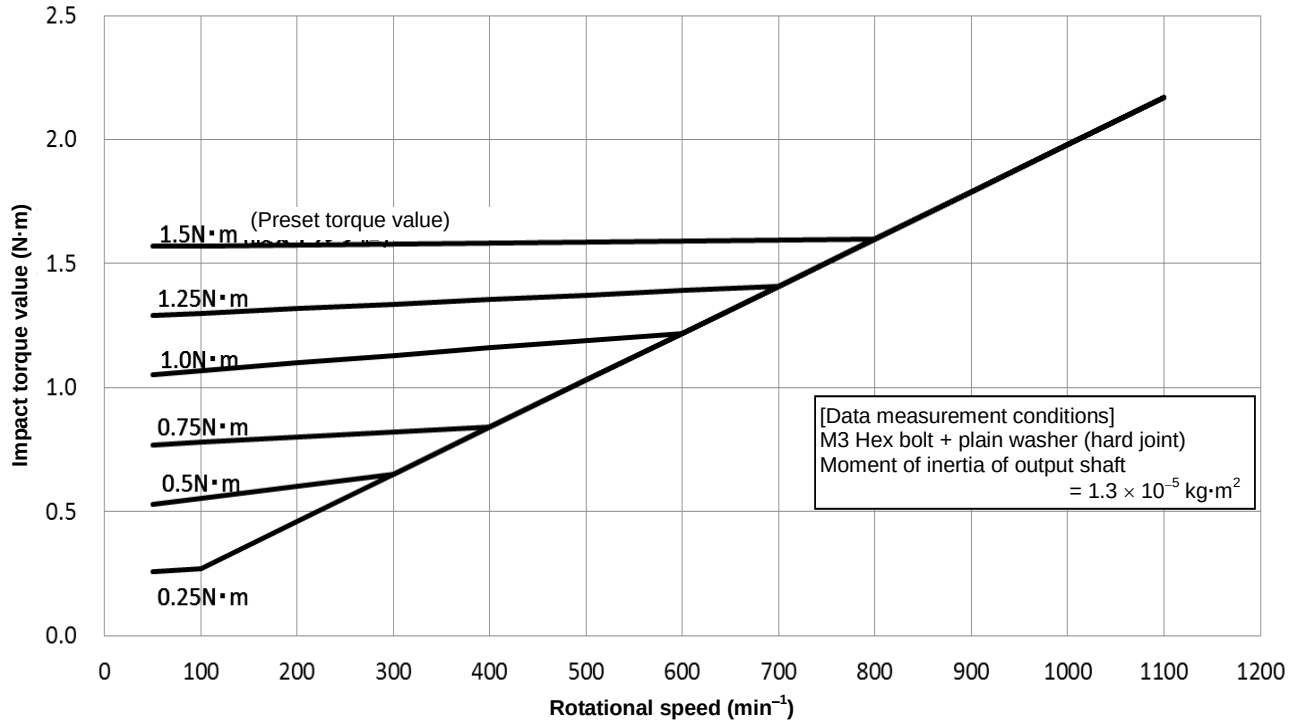
(Caution) Impact torque values determined according to the relationship between rotational speed and impact torque should only be used as a reference. Impact torque actually differs according to the screw or workpiece material.

(5) Trial fastening and adjustment
Set the SD600T controller to the conditions shown above, and perform trial fastening by using a torque checker or another similar device. If the torque is stable, the setup is complete.
If the torque is not stable, the final fastening rotational speed could be too high. If the final fastening rotational speed is higher than the value recommended in (2), lower the speed. If the problem persists, the initial rundown rotational speed might be too high, and the impact torque generated when a screw is seated might be the cause of the problem. In such a case, lower the initial rundown rotational speed.

This setting method is just an example. Settings differ depending on the screw type, workpiece, the direction of fastening, the shape of the output shaft, and other factors.
The following pages show the “relationship between rotational speed and impact torque” for each tool unit model. Data was measured by mounting a weight that assumes the drive shaft of our single-shaft screw fastening machine.

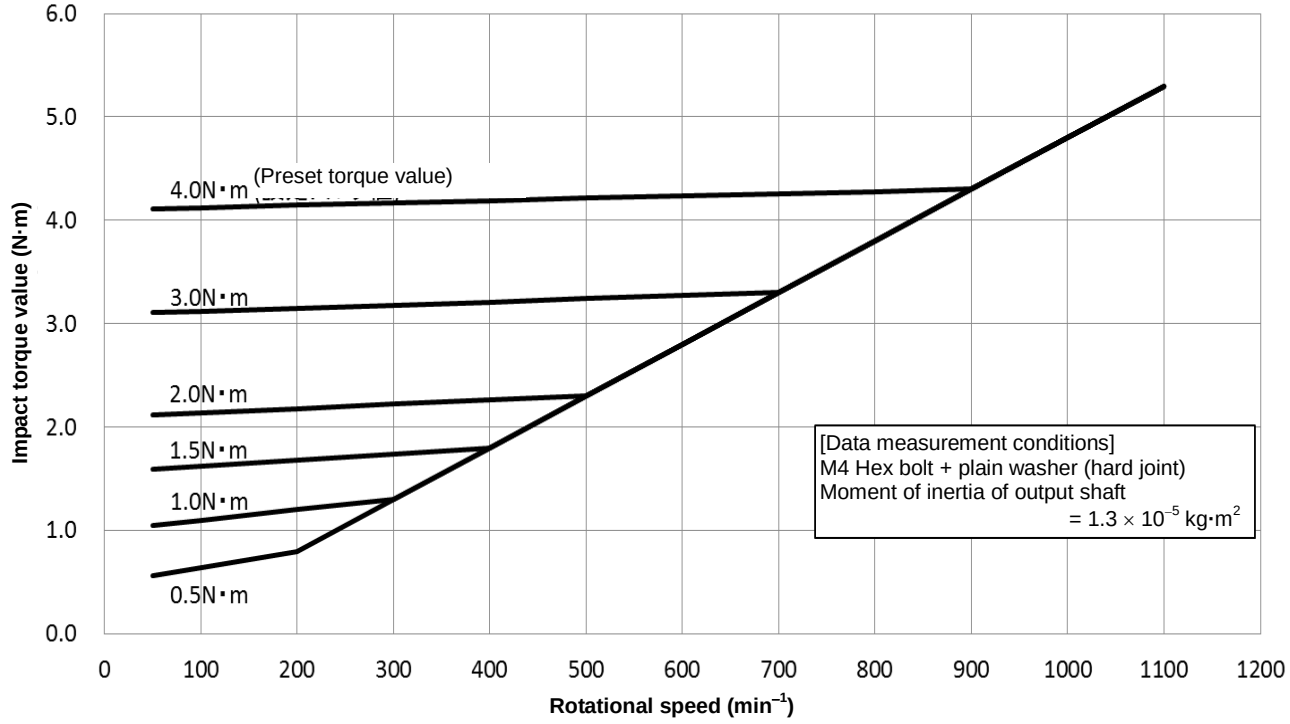
NX020T3

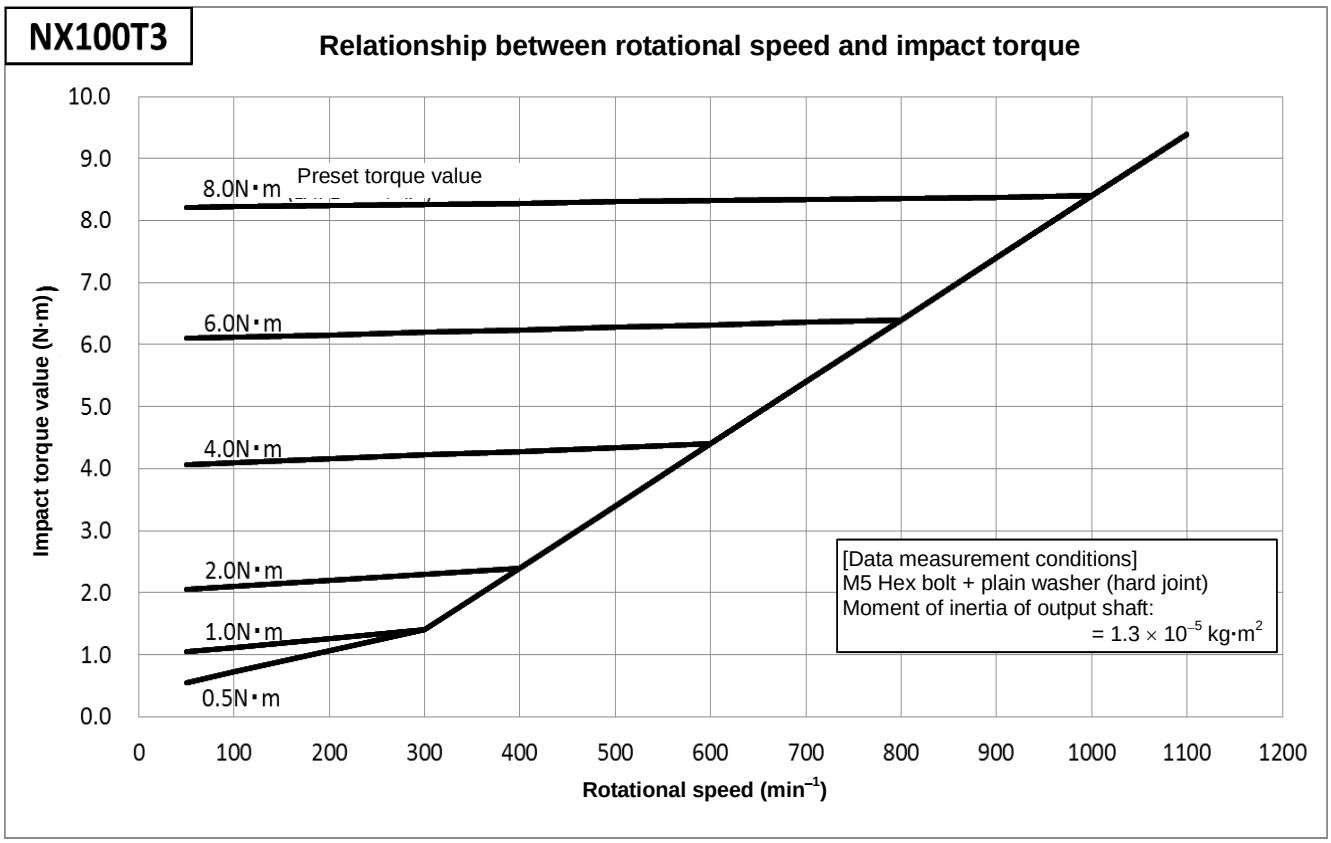
Relationship between rotational speed and impact torque



NX050T3

Relationship between rotational speed and impact torque




NX100T3
Relationship between rotational speed and impact torque
Impact torque value (N·m)
Rotational speed (min⁻¹)
Preset torque value
8.0N・m
6.0N・m
4.0N・m
2.0N・m
1.0N・m
0.5N・m
[Data measurement conditions]
M5 Hex bolt + plain washer (hard joint)
Moment of inertia of output shaft:
= 1.3 × 10⁻⁵ kg·m²
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0
100
200
300
400
500
600
700
800
900
1000
1100
1200

Maintenance and inspection

To maintain tool unit performance, it is necessary to grasp the conditions of the tool unit by performing routine inspections. Perform routine inspections according to the items in the following table.

- Perform inspections before starting operation.
- “Inspection cycle” in the table only gives a rough indication, so determine appropriate inspection intervals according to the use status or environment.
- Unless there are particular instructions, always turn the power off before performing maintenance, inspection, or other similar work.

No.	Inspection cycle	Inspection item	Inspection/maintenance instruction	Remarks
1	Daily	Connectors	Perform a visual and tactile inspection.	Free from looseness, removal, and contamination
2	Daily	Cables	Perform a visual and tactile inspection.	Free from damages, such as scratches and gouge
3	Every day	Vibration and sound	Check by touching and hearing	Increase in the level is not allowed.
4	According to the degree of contamination	Unit appearance	Cleaning using cloth or air	

Maintenance service (chargeable)

To enable normal use of the tool unit over an extended period of time, Nitto Seiko provides the following maintenance services (chargeable). **To use our maintenance services, your tool unit will need to be returned to our base. However, as we cannot prepare replacement tool units during maintenance, we request that spare tool units be prepared beforehand (or similar measures should be taken).**

1. Overhaul (replacing grease and inspecting for other deteriorated parts)
   The gear unit of the tool unit is filled with grease. Grease does not need to be replaced at short intervals, but replacing with fresh grease every three years or so contributes to extending the durability of mechanical parts such as gears. For this reason, regular overhauls are recommended.
   During overhaul, we also inspect for other deteriorated parts and may recommend parts replacement. For parts replacement, we submit estimates separately, and proceed to parts replacement after obtaining approval from customers.

2. Calibration of torque sensor
   In order to guarantee the precision of the output shaft torque of the tool unit, it is recommended calibrating the torque sensor periodically (every one million times of operation or yearly).

Troubleshooting

This chapter explains the causes and actions to be taken for typical problems that occur.
For electrical problems such as power supply connection failures or controller problems, refer to the SD600T Instruction Manual, provided separately.

Problem	Cause	Check points	Troubleshooting
1. Output shaft does not revolve, or shaft revolves but torque does not rise.	Damaged coupling	Check if motor is generating idle noises during final fastening.	Replacing tool unit
2. Output shaft does not revolve, or revolutions are unstable.	Damaged gear unit	Check if output shaft can be rotated lightly by hand.	Replacing tool unit
	Break in wire or breakage of connector	Cable and connector	Replacing tool unit or cable.
	Connection failure	Connector	Reconnect the connector.
	Motor failure	……	Replacing tool unit
3. Motor overload (A0010, A0011)	Ambient temperature is high.	Check ambient temperature.	Set ambient temperature to 40°C or less.
	Tool unit surfaces are dirty.	Entire tool unit	Clean the tool unit surfaces.
	Tool unit is used around the upper limit of the settable torque range. Or, tool unit is continuously operated at short downtime intervals.	Check the specified torque value. Check the fastening cycle of equipment.	• Replace the tool unit with the one whose torque range is one rank above the current range. • Increase the downtime interval between fastening points.
4. Abnormal sound is generated.	Loosen bolts	Fixing screws of each section	Re-fastening
	Bearing failure	Around output shaft or motor	Replacing tool unit

Appendix

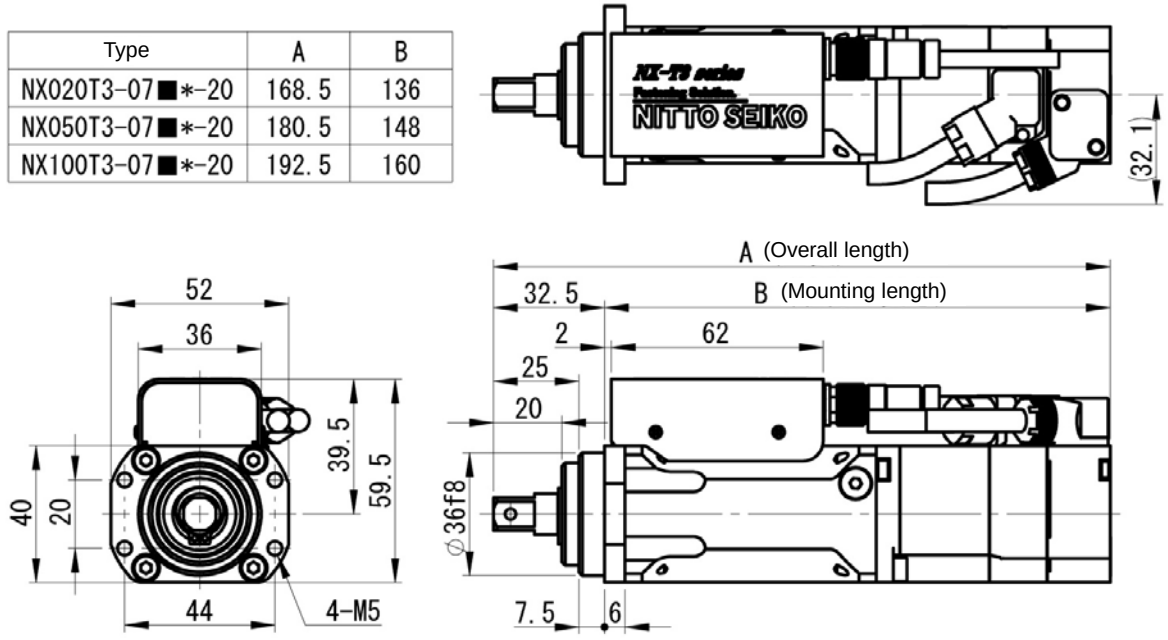
1. Specifications

Tool unit model	NX020T3-07■*-20	NX050T3-07■*-20	NX100T3-07■*-20
Settable torque range (N•m)	0.5–2.0	1.0–5.0	2.5–9.0
Maximum rotational speed (min^{-1})	1100		
Output torque accuracy	$3\sigma/\bar{x}$ = 3% or less	$3\sigma/\bar{x}$ =2% or less	
Torque sensor	Planetary gear type reaction torque sensor (strain gauge)		
Mass of tool unit (kg)	1.1	1.2	1.3
Applicable controller model	SD600T03-2020-*		SD600T05-2020-*

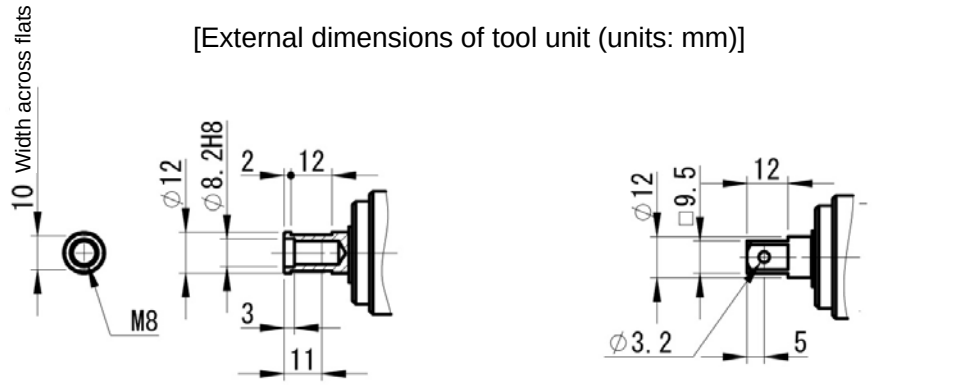
* In the table above, ■ indicates the shape of the output shaft, and * indicates our control number.

2. External dimensions ● NX020T3–NX100T3

Type	A	B
NX020T3-07■*-20	168.5	136
NX050T3-07■*-20	180.5	148
NX100T3-07■*-20	192.5	160



[External dimensions of tool unit (units: mm)]



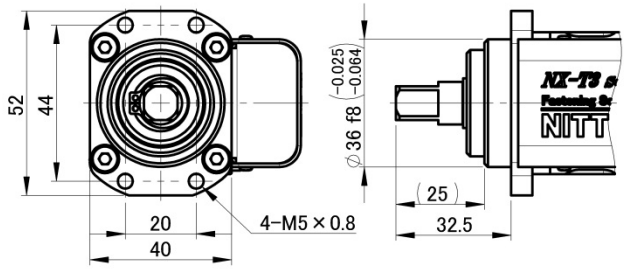
M: Screw-in specification (M8)　　S: Square shaft specification (9.5 sq.)

[Dimensions of output shaft end (units: mm)]

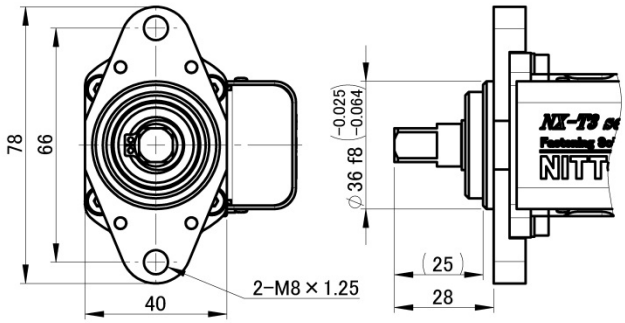
3. Compatibility of tool installation

The NX driver T3 series is compatible with the T2 series because their tool mounting dimensions (such as the mounting pitch, the length between the output shaft end and the flange, hole sizes) are the same, but is not compatible with the TU series because their mounting pitches are different.
If installation using the same mounting pitch as the TU series is required, a T3 series tool can be replaced with a TU series tool by using an optional TU-series compatible flange. If this option is used, the tool mounting dimensions (such as the length between the output shaft end and the flange and hole sizes) will become the same as for the TU series.

T3 series

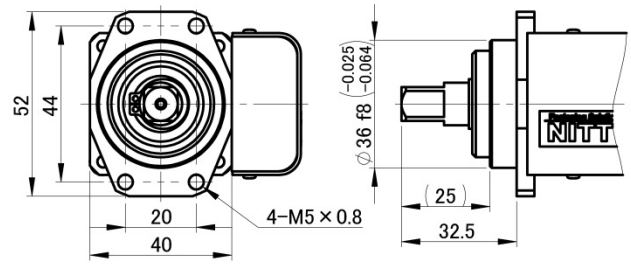


NX-T3 series: Standard specifications

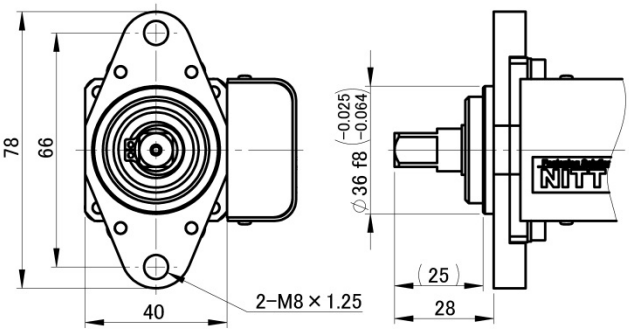


NX-T3 series: BU specifications (with TU-series compatible flange)

T2 series

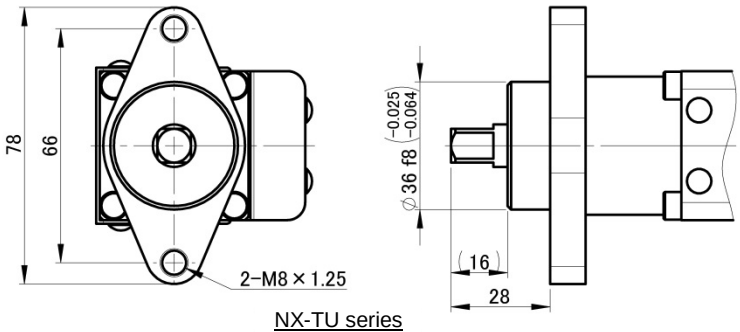


NX-T2 series: Standard specifications



NX-T2 series: BU specifications (with TU-series compatible flange)

TU series



NX-TU series

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