# τ DISC Servo Motor
タウ
# ND-s series

## Standard

Rated torque:3.4～500 N·m

◎Popular standard Type pursuing cost performance. Suitable for various applications.

◎Compact design. Higher torque density and optimized thermal structure and magnetic circuitry have reduced the volume ratio by 25% from previous models (ND and ND-c Series).

**Point!**

**!** **Ideal for converting the AC servo motor + reducer mechanism into a direct drive system**

**Application examples** ■Wafer carrier devices/ ■Food carrier devices/ ■Filling machines/ ■Capping machines/ ■Roll feeders/ ■Laser beam machines/ ■Laminating machines/ ■FPD pasting machines/ ■Die cutters/ ■Screen printing machines/ ■Contact and non-contact inspection machines/ ■Index tables

---

Index drive and tightening drive：
**Index machines, capping machines, etc.**

τ DISC
Capping machine
Torque sensor
Cap tightening

【Index machines】
● High-precision, flexible indexing
● Simple structure
● Quietness
● Improved maintainability

【Capping machine】
● The hollow structure makes the device simpler
● Faster response

Index machines
τ DISC

---

Feeding and winding drive (roll-to-roll application devices)：
**Laminating machines, coaters, surface inspection machines, etc.**
**Replacing a powder clutch or brake**

Feeding machine
Winding machine

τ DISC
τ DISC
● Speed stability
● Quietness
● Improved maintainability
● Easy adjustment

---

Rotary drive：
**Die cutters, printing machines, etc.**

Die roll

● Speed stability
● Simple structure
● Improved maintainability

τ DISC

---

Transport robot drive：
**Wafer transport robots, etc.**

● The hollow structure makes the device simpler.
● Quietness
● Improved maintainability

τ DISC (For pivot axis drive)
τ DISC (For arm drive②)
τ DISC (For arm drive①)

---

Table drive：
**Laser beam machines, various processing machines, etc.**

● Stable operation
● High precision
● Improved maintainability

Rotation axis τ DISC
Inclined axis τ DISC

# τDISC Servo Motor ND-s HS series

Rated torque：8〜24 N·m

## High-speed rotation

◎ High-speed rotation specification model of the ND-s Series.

◎ Pursuing compactness and high-speed operation.

◎ Lineup of motors whose rated rotation speed ranges from 11 to 15 rps (660 to 900 rpm).

**Point!**

! **Ideal for applications that require high-speed and high-precision operation**

## Application examples

■ Die bonders
■ Sorters
■ Spin coaters
■ Spin washers

### High-speed positioning examples

**90-degree positioning time：36 msec**

**180-degree positioning time：60 msec**

Accuracy at the arm tip: ±4 $\mu$m (completion range: ±10 pulses)

● Used motor Type and specifications
ND140-95-LS-HS Type
Rated/maximum torque：15/37 N·m
Rated rotation speed：11 rps
Rotor moment of inertia：0.00134 kg·㎡
Detection pulse：1,600,000 ppr

● Load specifications
Arm load (double edge): Weight of 0.086 kg
（208 mm from center to tip）
Load inertia moment ratio: Approx. 0.5 times

---

### High-speed pick-and-place drive：
### Die bonders and sorters

τDISC

● Faster operation
● High-precision positioning
● Simple structure and space saving

High-speed 90-degree positioning

High-speed 180-degree positioning

---
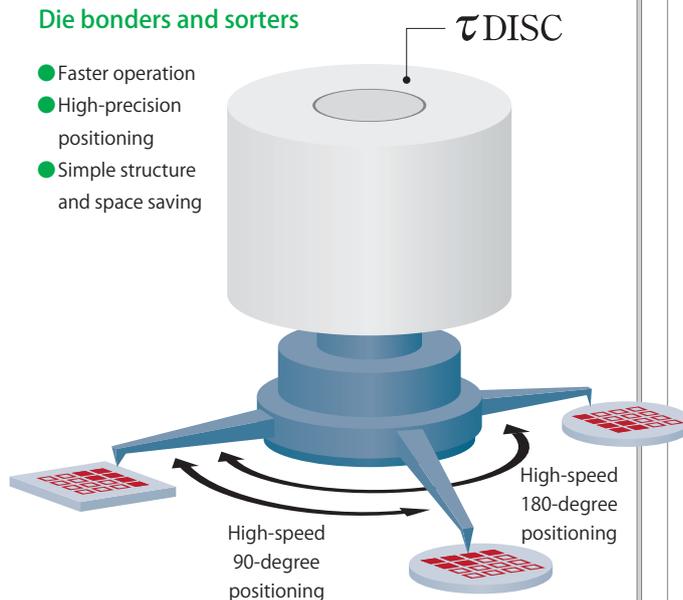
### Spin drive：
### Spin coaters, spin washers, etc.

● Speed stability
● Simple structure
● High acceleration

High-speed rotation operation

Wafer
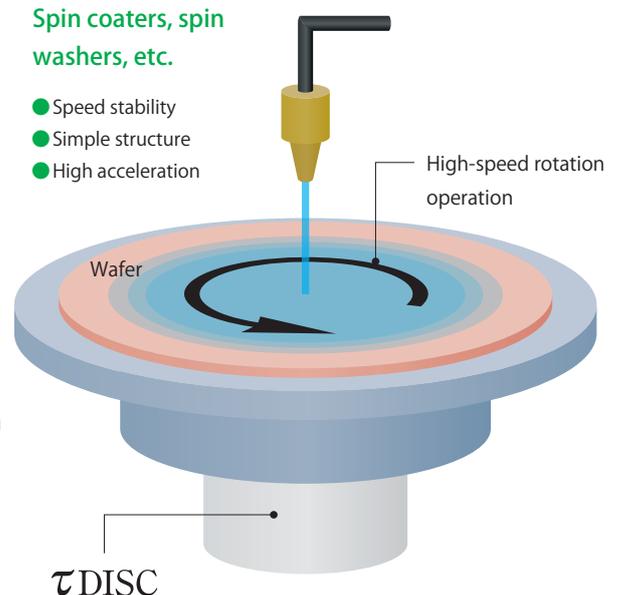
τDISC

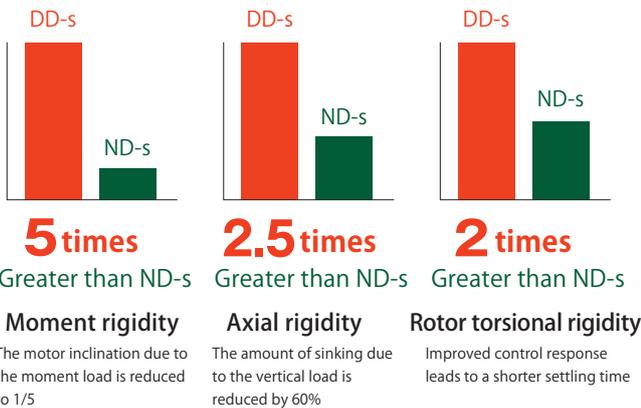# τDISC® Servo Motor DD-s series

## High rigidity and high precision

**Rated torque：10～2000 N・m**

◎ High-rigidity Type pursuing high rigidity and high precision.

◎ Significant improvement in moment rigidity, axial rigidity, and rotor torsional rigidity.

◎ Pursuing positioning accuracy and run out accuracy.

◎ Enabling stable operation even at the inertia ratio of 2,000 times. ＊

　＊ They are not guaranteed values. They depend on the installation status, operation conditions, mechanical rigidity, etc.

**Point!**

**！ Ideal for applications that require stable operation for a load with large inertia**

---

DD-s / ND-s

**5 times** Greater than ND-s

### Moment rigidity
The motor inclination due to the moment load is reduced to 1/5

DD-s / ND-s

**2.5 times** Greater than ND-s

### Axial rigidity
The amount of sinking due to the vertical load is reduced by 60%

DD-s / ND-s

**2 times** Greater than ND-s

### Rotor torsional rigidity
Improved control response leads to a shorter settling time

### Application examples

■FPD pasting machines/ ■FPD inspection machines/ ■Screen printing machines/

■PE printing machines/ ■Precision processing and measurement machines/

■Wafer dicing machines/ ■Wafer processing machines/ ■Wafer inspection machines/

■Scribers/ ■Die casting machines/ ■Packaging machines/ ■X-ray analyzers/
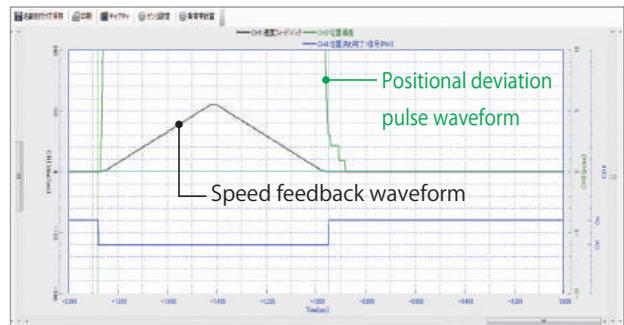
■Surface polishing machines/ ■Chamfering machines

▼ Positioning operation waveforms when the inertia ratio is 527 times



Positional deviation pulse waveform

Speed feedback waveform

【Used motor Type and specifications】 **DD160-146-LS Type**

● Rated/maximum torque：27/62.5 N・m

● Rotor moment of inertia：0.0074 kg・m²

● Load specifications (disk) Load inertia moment：3.9 kg・m²
　（527 times larger than rotor moment of inertia）

● Positioning operation：90°

● Paired servo driver：VPH-HA Type

＊ These values may vary depending on the load setting condition and other factors.They are not guaranteed values.

---

### High-precision roll drive：
### Roll coaters, PE printing machines, etc.

Printing roll　τDISC

● High-precision positioning

● Speed stability

τDISC　Gantry linear　Glass, film, etc.

---

### Ball screw drive：
### Die casting machines, servo presses, etc.

τDISC

● High-response operation

● The hollow structure makes the device simpler

● Improvement in environmental friendliness and safety due to not using a hydraulic system

Ball screw

---

### Large inertia load turning drive：
### FPD turning, alignment, and inspection machines

● Stable operation for a load with large inertia

● High-precision positioning

● Simple structure and space saving

τDISC

---

### Continuous rotation drive：
### Surface polishing machines, chamfering machines, etc.

τDISC

● High-precision positioning

● Speed stability

τDISC

# τDISC® Servo Motor *HD-s* series

Rated torque：27〜68 N･m

# High response

◎ High-response Type pursuing high-speed operation.

◎ World's top level high response performance with a high-torque, low-inertia structure.

**!** Ideal for applications that require a small operation angle and high-speed operation

▼ Positioning operation waveform at 22.5° Positioning time：18.2 msec



Speed feedback waveform

Positioning completion signal
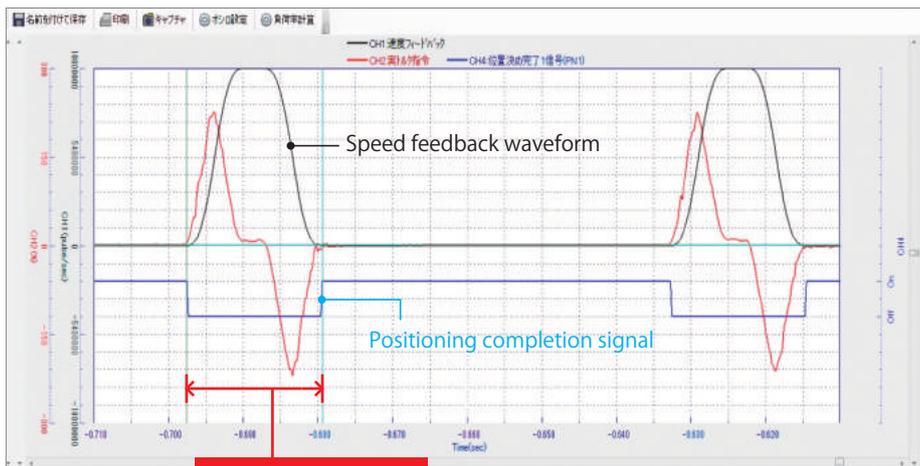
**18.2 msec**

● Used motor Type and specifications
  HD140-160-LS Type
  Rated/maximum torque：27/67.5 N･m
  Rotor moment of inertia：0.0027 kg･㎡
● Load specifications (disk)
  Load weight：0.79 kg
  Load inertia moment：0.00297 kg･㎡
  （1.1 times larger than rotor moment of inertia）
● Positioning operation：22.5°
  Completion range：±10 pulses
  （Load disk circumference conversion：±1.5 $\mu$m）
  Dwell time：50 msec
● Paired servo driver：
  VPH-HA Type

\* These values may vary depending on the load setting condition and other factors. They are not guaranteed values.

**Application examples** ■Test handlers/ ■Taping machines/ ■Appearance inspection machines/ ■Automotive parts testing machines/ ■Torque testing machines/ ■Various testing machines/ ■Vibration generators

---

High-speed index drive：
**High-speed test handlers and taping machines**

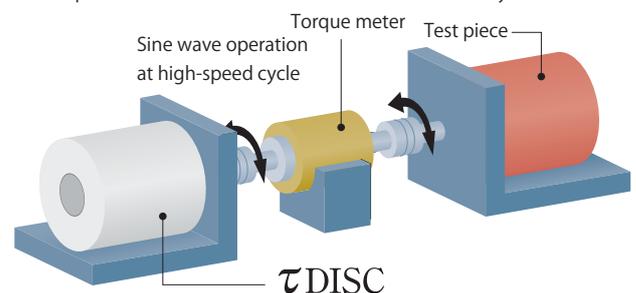High-speed indexing operation for 22.5 degrees
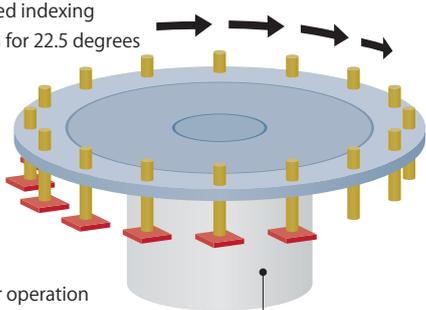
● Faster operation
● High-speed positioning
● Simple structure and space saving

τDISC

---

Testing machine drive：
**Torque testing machines, material testing machines, durability testing machines, etc.**

● High-response operation
● Space savings and improved quietness
● Improvement in environmental friendliness and safety

Sine wave operation at high-speed cycle

Torque meter

Test piece

τDISC

# τDISC® Servo Motor Customization

## Custom Made

In addition to the standard τDISC lineup, we can offer custom-made features, such as those shown below, to meet your needs for special specifications.

---

**Custom Made 1**

### Improved speed stability

Based on the ND250-s and ND400-s Types of the ND-s Series, speed stability is improved by reducing motor torque ripples, mounting a high-precision encoder, etc.

**Speed variation**
[At speed of 2 rpm]

# ±0.1%

Actual value obtained under our measurement conditions

---

**Custom Made 2**

### Built-in motor
【Example】

We provide an air bearing or ball bearing spindle with a rotor and a stator built in it or only a rotor and a stator.

Rotary encoder

Bearing　Rotor (rotating side)　Stator (fixed side)

---

| Custom Made 3 | Anti-fretting specifications | Custom Made 4 | Improved positioning accuracy and rotation accuracy | Custom Made 5 | Improved torque accuracy |
|---|---|---|---|---|---|
| Custom Made 6 | Improved flatness and parallelism | Custom Made 7 | Increased rotation speed and torque | Custom Made 8 | Anti-dust specification |
| Custom Made 9 | Material and appearance changes | Custom Made 10 | Wider middle hole diameter and change in the mounting shape | Custom Made 11 | Connector and cable changes |

---

### We can support any special shipping inspection.

By conducting a dedicated inspection not supported as standard, it is possible to check whether your required specifications are met, regarding the specifications not provided as such.

● Positioning accuracy measurement using laser length measurement and a high-precision encoder　● Table rotation axis run out accuracy using a true sphere
● Load displacement amount measurement　● Speed stability, output torque accuracy, etc.

* For information about the availability of customization, contact our sales staff.

* Our website offers "List of Practical Examples of Custom-Made Direct Drive Motors".

https://www.nikkidenso.co.jp/product/custom/

# VPH Series

Developed exclusively for direct drive.
Maximizes the motor performance.

Output capacity 100 W～15 kW

## Lineup

| | | |
|---|---|---|
| ◎ VPH-HA Type | I/O specification | Speed command operation, torque command operation, and pulse train command operation, and built-in command operation |
| ◎ VPH-HB Type | SSCNET III/H specification | Supports SSCNET III/H and SSCNET III. Speed command operation, torque command operation, and position control operation |
| ◎ VPH-HC Type | CC-Link specification | Supports CC-Link (Version 1.10) communication. Speed command operation, torque command operation, and pulse train command operation, and built-in command operation |
| ◎ VPH-HD Type | EtherCAT specification | Supports EtherCAT communication (CiA402 drive profile). Speed command operation, torque command operation, and position control operation |
| ◎ VPH-HE Type | MECHATROLINK-III specification | Supports MECHATROLINK-III communication. Speed command operation, torque command operation, and position control operation |

## Features

### Superb speed stability

**Significant reduction in torque ripples**

Reducing torque ripples improves speed stability even more.
(Reduced by 20% from the conventional model.)

### Easy tuning even for a load with large inertia

**Automatic feedback filter setting function**

Since the feedback filter appropriate for the load is automatically set during auto tuning, the speed detection ripples are reduced, allowing easy tuning even for a load with large inertia. Smooth operation can be achieved easily.

### Improved stability during stop

**Filtering function during stop**
**Improved torque accuracy during stop**

Vibration of a load with large inertia during stop is reduced.

**Enhanced low-speed gain switching function**

Not only speed but also other items, such as deviation and the presence or absence of a command, can be set as the conditions for switching between normal gain and low-speed gain.

### Smooth operation reduces the positioning time.

**Two-stage, s-curve acceleration and deceleration control function**

Making the torque waveform a quadratic curve significantly eases the impact at the time of acceleration and deceleration and reduces the positioning time without causing vibration even when the acceleration and deceleration is shortened.

*For the VPH Series*

# System support tool

**The enhanced adjustment, monitoring, operation, analysis, and editing functions assist in mechanical system matching and enable efficient start-up.**

Oscilloscope screen

# Analysis functions

## Oscilloscope function

● The servo data of up to 11 channels can be displayed in real time.
(* Data resolution: 0.4 ms or more; Only IO setting for Channel 4 and later)
● The motor load ratio during repeated operations can be displayed easily.
● The normal trigger function makes it easy to identify changes before and after adjustment.

## Frequency response measurement function

● By measuring the frequency response of the mechanical system through automatic motor excitation, the mechanical resonance filter can be set easily.
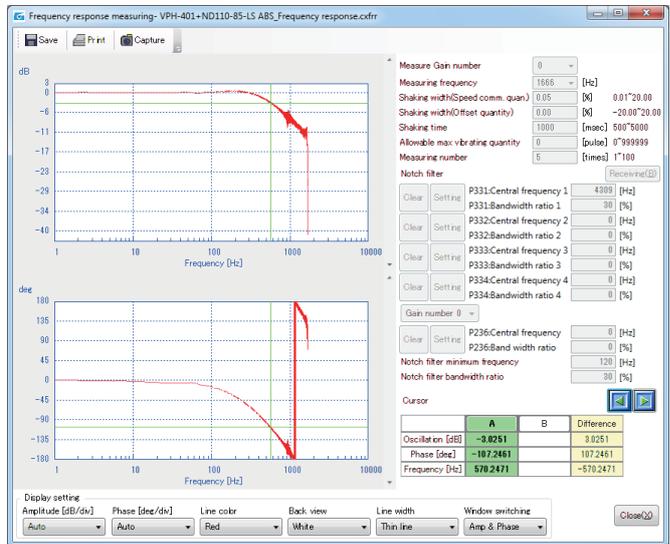
## Frequency spectrum measurement function

● By finding the mechanical resonance point through the measurement of the frequency spectrum during the operation, the mechanical resonance filter can be set easily.
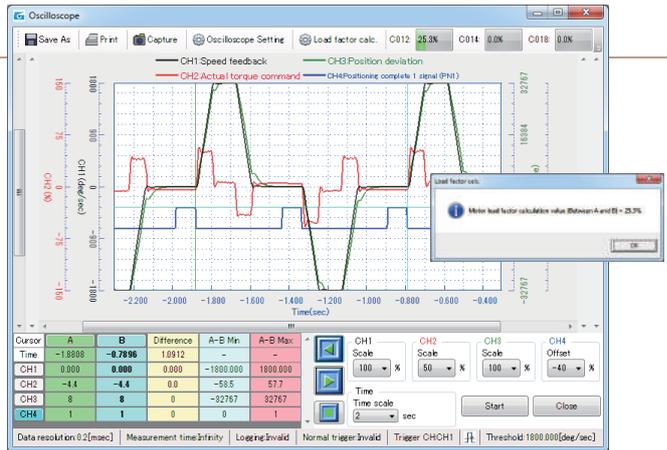
Frequency response measurement screen

Frequency spectrum measurement screen
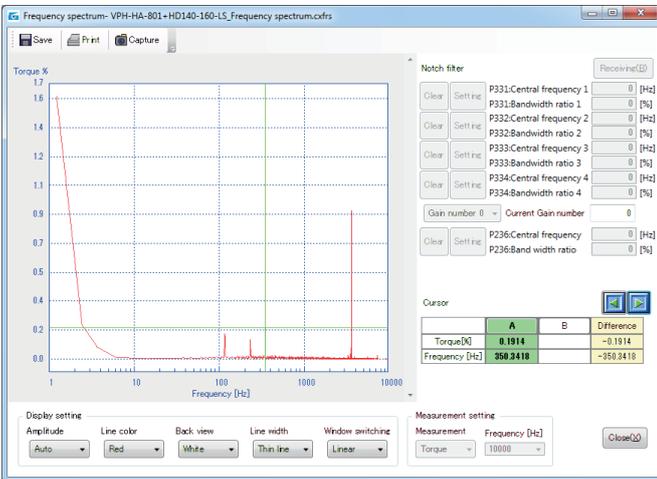
# Status display

## Status display function

● Various operation information, such as the actual motor operation speed, actual torque command, and current position, is displayed in real time.
● The alarm history, device information, and so on are displayed.

## Input/output signal status display function

● The input and output signals can be checked easily during the start-up operation.

## Device monitoring function

● The memory area inside the driver can be displayed and edited in real time.

Status display screen

* Download the latest version of the VPH Series system support tool from our website.
https://www.nikkidenso.co.jp/systemtool/

Parameter editing screen



# Data editing

## Parameter editing function

● The parameters such as gain, filter, command, and signal are grouped to make the editing work easier.

## Program editing function

● Programs can be created and edited using the operation commands in internal command mode.

## Indirect data editing function

● This function creates and edits the indirect data to be used for program operation.

# Remote operation

## Switch box function

● Remote operation can be done easily from a PC with the master controller disconnected.

Switch box screen



# Automatic servo gain adjustment function "NiEAT"

## New functions of the system support tool (For details, refer to p.13 to p.14.)

● Interactive initial setup is supported for the major control method.
● Enter selection conditions to the direct drive motor selection calculation tool, and you can have the filter and gain value automatically adjusted until the selection conditions are met.
● A special motor parameter read function has been added. Special motor parameters can be created easily.

**NiEAT**
**Ni**kkidenso
**E**ngineering
**A**uto **T**uning

### Supported OS

● Windows10　32bit/64bit
● Windows8.1　32bit/64bit
● Windows7　32bit/64bit

### Supported languages

● Japanese, English, and Korean
Chinese (simplified/traditional)

# New!
## Automatic servo gain adjustment function

# NiEAT

**Ni**kkidenso
**E**ngineering
**A**uto **T**uning

The system support tool features a new function - the automatic servo gain adjustment function "NiEAT"!

The formerly difficult task of adjusting the direct drive motor gain is now easy to do!

Comparison between automatic servo gain adjustment of NiEAT and conventional adjustment

## Conventional adjustment...

Setting a large number of parameters is cumbersome.

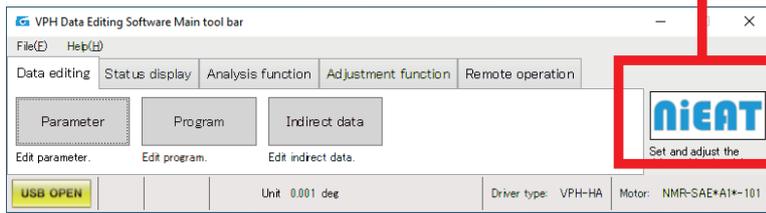Which do I need to use to drive the motor?
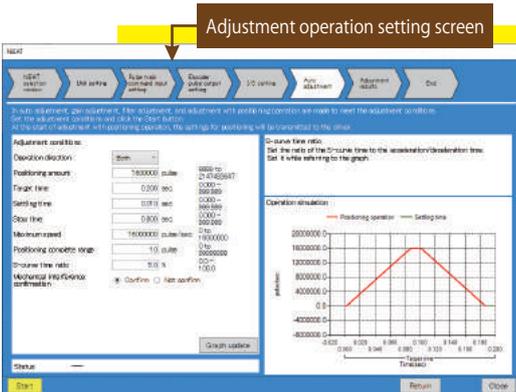
I'm not sure what to set.

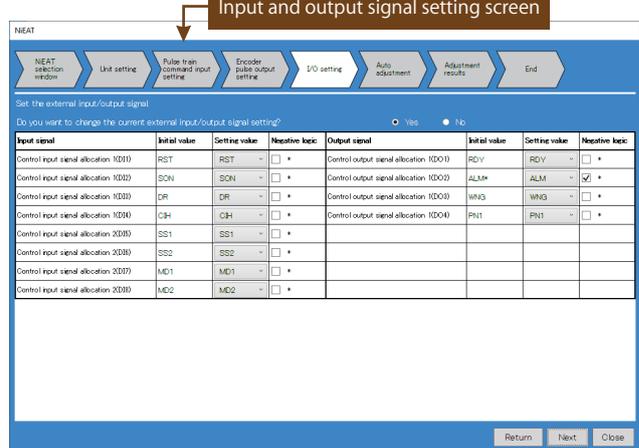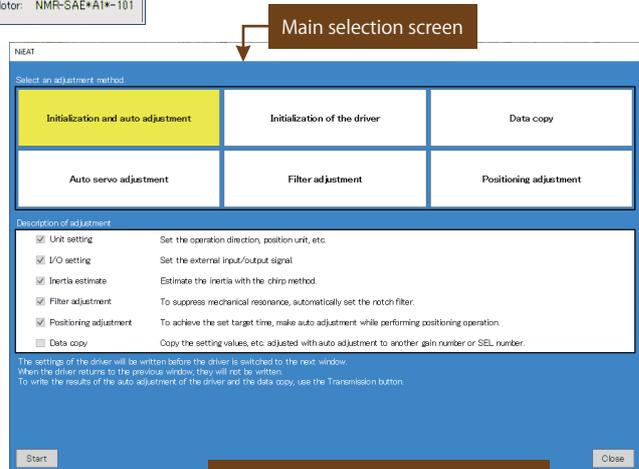How do I know if I'm finished with adjusting the gain waveform?

I don't know how to cope with mechanical resonance.

## "NiEAT" solves all these problems!

[VPH system support tool screen]

**To start the tool, click the NiEAT button!**

VPH Data Editing Software Main tool bar

File(F)　　Help(H)

Data editing　Status display　Analysis function　Adjustment function　Remote operation

Parameter　　Program　　Indirect data

Edit parameter.　Edit program.　Edit indirect data.

USB OPEN　　Unit 0.001 deg　　Driver type: VPH-HA　Motor: NMR-SAE*A1*-101

NiEAT — Set and adjust the
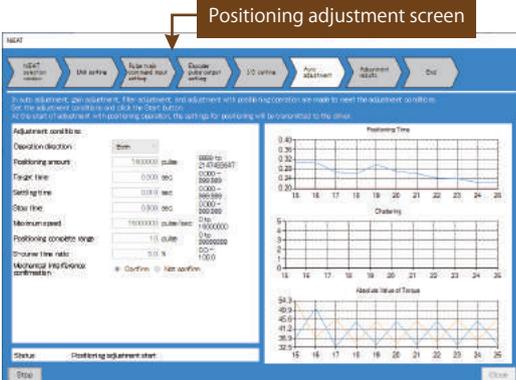
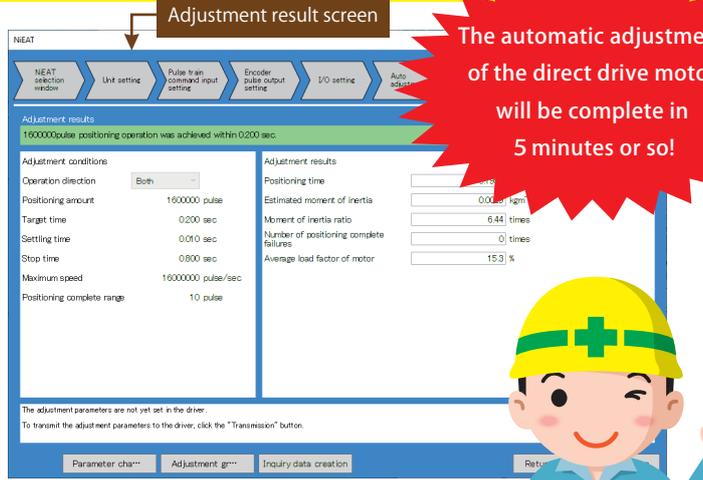**The wizard takes you through the adjustment process. All you need to do is make settings according to on-screen instructions!**

Main selection screen

Select an adjustment method.

| Initialization and auto adjustment | Initialization of the driver | Data copy |
| Auto servo adjustment | Filter adjustment | Positioning adjustment |

Description of adjustment

☑ Unit setting — Set the operation direction, position unit, etc.
☑ I/O setting — Set the external input/output signal.
☑ Inertia estimate — Estimate the inertia with the chirp method.
☑ Filter adjustment — To suppress mechanical resonance, automatically set the notch filter.
☑ Positioning adjustment — To achieve the set target time, make auto adjustment while performing positioning operation.
☐ Data copy — Copy the setting values, etc. adjusted with auto adjustment to another gain number or SEL number.

The settings of the driver will be written before the driver is switched to the next window.
When the driver returns to the previous window, they will not be written.
To write the results of the auto adjustment of the driver and the data copy, use the Transmission button.

Start　　Close

Unit setting screen

Input and output signal setting screen

Adjustment operation setting screen

**Input the adjustment conditions and click the Start button, and automatic adjustment will start! There is no need to check the adjustment status by monitoring waveforms or set a filter for the mechanical resonance point by using another function.**

Adjustment result screen

**The automatic adjustment of the direct drive motor will be complete in 5 minutes or so!**

Positioning adjustment screen

Adjustment results

1600000pulse positioning operation was achieved within 0.200 sec.

| Adjustment conditions | | Adjustment results | |
| Operation direction | Both | Positioning time | |
| Positioning amount | 1600000 pulse | Estimated moment of inertia | 0.00 kgm |
| Target time | 0.200 sec | Moment of inertia ratio | 6.44 times |
| Settling time | 0.010 sec | Number of positioning complete failures | 0 times |
| Stop time | 0.800 sec | Average load factor of motor | 15.3 % |
| Maximum speed | 16000000 pulse/sec | | |
| Positioning complete range | 10 pulse | | |

The adjustment parameters are not yet set in the driver.
To transmit the adjustment parameters to the driver, click the "Transmission" button.

Parameter cha...　Adjustment gr...　Inquiry data creation　Return

* If NiEAT cannot automatically adjust the motor, you need to make adjustments individually.
* The NiEAT function does not include adjustments other than the gain adjustment, such as the height and level adjustments for motor parallelism.

14