

ENGINEERING PUBLICATION
MOTION CONTROL DIVISION

PRODUCT: NS300/NS500 SUBJECT: CONFIGURING NS300/500

CATEGORY: TECH. SUPPLEMENT

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Summary: This document is a supplement to the JUSP-NS300 and JUSP-NS500 user manual. This document provides tips on configuring the JUSP-NS300 and JUSP-NS500.

Tips on Configuring Fieldbus Application Modules. JUSP-NS300 and JUSP-NS500.

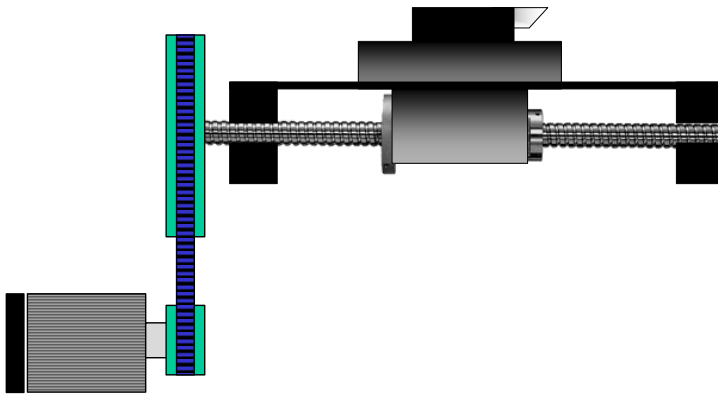
This document discusses the parameters that are most commonly used to achieve basic point-to-point positioning or jogging. This document should be used in conjunction with the JUSP-NS300 or JUSP-NS500 user manual. The parameters discussed are only the most common parameters. More parameters may need to be adjusted depending on the mode of positioning. The manual can be found at FTP.YASKAWA.COM under Public/Development/Servo. These configurations are most commonly completed with the associated electronic data sheets. The parameters can also be changed with Yaskawa's NSxxx software and a YS-16 cable. NSxxx software, the NS300 EDS sheet, and a document titled "NSxxx Configuration Guide" can be found at FTP.YASKAWA.COM under Public/Development/Servo.

NOTE - After editing the parameters, make sure to perform a system reset to save the parameters to non-volatile memory.

1) Set the electronic gear ratio.

Pn810 and **Pn811** are the numerator and denominator for the electronic gear ratio. This ratio allows the NS300 or NS500 to be programmed in user units. First decide on what units will be used. Second, choose the smallest increment of a user unit. The smallest increment of the user unit is called a Reference Unit. The user must decide on the appropriate level of position resolution by choosing the reference unit value. The NS300/NS500 user's manual will interchange the terms Reference Units and Steps.

For example.



The diagram above shows a ball screw actuator with a 4:1 reduction timing belt pulley. The ball screw has a 10 mm per rev pitch. Since the ball screw is metric, the most obvious choice of units is millimeters. The user must decide the smallest increment of motion. For this example we will choose [0.001 mm]. The motor is an SGMAH-02AAF41 with 8192 encoder counts per revolution.

One Reference Unit or 1 [R.U.] = [0.001 mm] or
1,000 [R.U.] = 1 [mm]

The electronic gear ratio sets the number of encoder counts per Reference Unit.

$$\frac{\text{Pn810}}{\text{Pn811}} = \frac{\text{Encoder Counts per revolution of Load Shaft}}{\text{R.U.s per revolution of the Load Shaft}} \quad \text{Equation 1}$$

$$\frac{\text{Pn810}}{\text{Pn811}} = \frac{\text{Encoder counts per mm (or per inch)}}{\text{R.U.s per mm (or per inch)}} \quad \text{Equation 2}$$

Equation 2 is valid, but often produces values that are non-integer. All parameters need to be integer values. Therefore, Equation 1 is more practical.

Using Equation 2 for the Example yields.

$$\text{Pn810} = \frac{8192 \text{ encoder counts}}{\text{Rev of motor}} \times \frac{4 \text{ Revs of the motor}}{1 \text{ rev of the load}} = 32786 \text{ encoder counts per rev of the load shaft}$$

$$Pn811 = \frac{1000 \text{ R.U.}}{1 \text{ mm}} \times \frac{10 \text{ mm}}{\text{load shaft revolution}} = 10,000 \text{ R.U.s per rev of the load shaft}$$

Be sure to check that Pn810 and Pn811 are in range.

$$Pn810 \leq 10,000,000$$

$$Pn811 \leq 10,000,000$$

$$100 \geq \frac{Pn810}{Pn811} \geq 0.01$$

2) Set the maximum feed speed

Pn843 is the maximum feed speed. This parameter limits the speed of the servomotor during feeding (jogging), positioning, and homing. This parameter can be set lower than the servomotors top speed to protect the mechanics of the machine. Make sure that this parameter is not set higher than the servomotor's top speed. Setting Pn843 higher than the servo's top speed will risk nuisance Overspeed alarms.

Pn 843 is set in the following units. [1000 R.U./min]

For the example above, set the maximum feed speed to the motors max speed. The SGMAH-02AAF41's max speed is 5000 rpm.

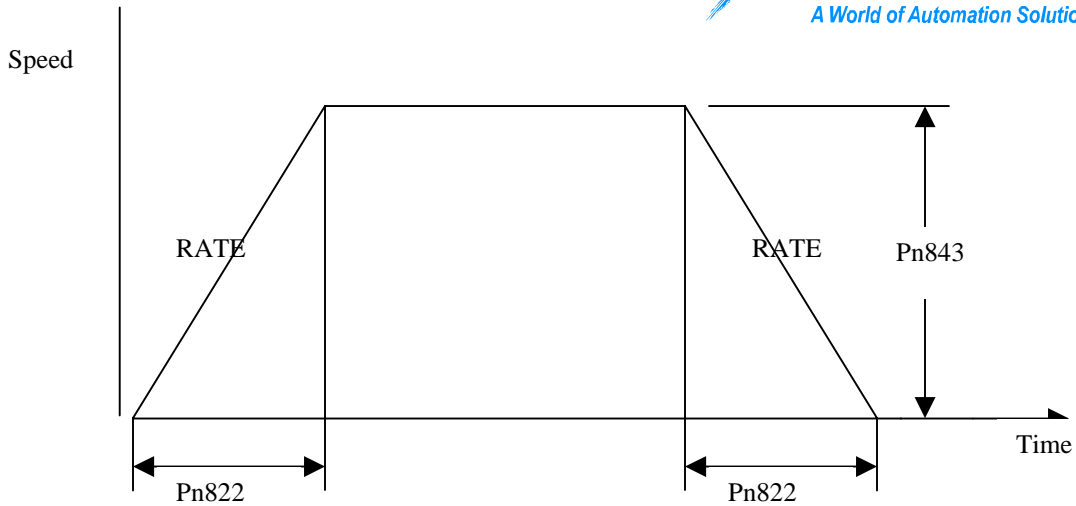
$$Pn843 = \frac{5000 \text{ motor revs}}{\text{min}} \times \frac{1 \text{ load shaft rev}}{4 \text{ motor revs}} \times \frac{10 \text{ mm}}{1 \text{ load shaft rev}} = 12500 \left[\frac{\text{mm}}{\text{min}} \right]$$

$$Pn843 = \frac{12500 \text{ mm}}{\text{min}} \times \frac{1 [1000 \text{ R.U.}]}{1 \text{ mm}} = 12,500 \left[\frac{1000 \text{ R.U.}}{\text{min}} \right]$$

3) Set the Acceleration and Deceleration type.

The NS300/NS500 is capable of several different acceleration and deceleration profiles. The most commonly used is a constant linear acceleration. Set the Accel/Decel type, **Pn826**, to 1 for a linear acceleration with acceleration rate equal to deceleration rate. For other profiles see section 4.3.4 of the NS300/500 user manual. **Pn836** works the same way for setting the acceleration profile for feeding (jogging).

4) Set the Acceleration and Deceleration rate

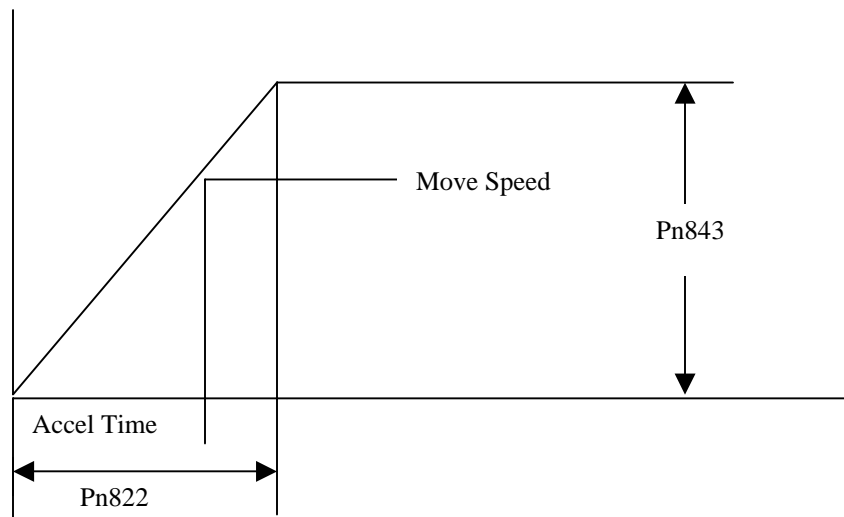


Pn822 sets the acceleration time from zero speed to the maximum feed speed (Pn843). Pn843 and Pn822 in combination define a constant acceleration RATE used for positioning. With Accel/Decel type (Pn826) set to 1, Pn822 also defines a constant deceleration RATE for positioning.

For example, set Pn822 to 500 milliseconds. Pn843 = 12,500 [mm/min] from Step 2.

$$\text{Rate} = \frac{12500 \text{ mm}}{\text{min}} \times \frac{1}{500 \text{ ms}} \times \frac{1 \text{ min}}{60 \text{ sec}} \times \frac{1000 \text{ ms}}{1 \text{ sec}} = 416.67 \text{ mm/sec/sec}$$

This RATE is used for all positioning moves. Because the RATE is constant, the acceleration TIME will be smaller if the final move speed is lower than that set in Pn843. See the diagram below.



The same principal applies to the acceleration RATE for feeding (jogging) and homing. Use **Pn832** to set the acceleration time and define the acceleration rate for feeding (jogging). **Pn80A** sets the acceleration time and defines the acceleration rate for homing. All three acceleration time parameters work with the Maximum Feed Speed, Pn843.

5) Set the Feed Speed for Positioning, Feeding (Jogging), and Homing.

Pn821 defines the Feed Speed for positioning in 1000 R.U. per min. Make sure the Feed Speed for positioning is set lower than the Max Feed Speed set in step 5 above.

From the example in step 2

$$Pn843 = \frac{5000 \text{ motor revs}}{\text{min}} \times \frac{1 \text{ load shaft rev}}{4 \text{ motor revs}} \times \frac{10\text{mm}}{1 \text{ load shaft rev}} = 12500 \text{ [mm/min]}$$

$$Pn821 \leq 12500 \text{ [mm/min]}$$

The feed speed for positioning, Pn821, is in effect for the STEP command, the STN command, and SIMPLE POSITIONING.

Pn831 defines the Constant Feed Speed for Feeding (Jogging) in 1000 R.U. per min. Make sure the Feed Speed for Feeding, Pn831, is set lower than the Max Feed Speed. The Constant Feed speed is in effect for Feeding only.

Pn830 defines the units used to command speed in the Feed (jog) mode. The default value of 0 means speed commands will be in a percentage of the Constant Feed Speed for Feeding (Pn831)

Pn803 defines the Approach Speed for Homing in 1000 R.U. per min. Make sure the Approach Speed for Homing is set lower than the Max Feed Speed. The Approach speed for homing is in effect for Homing only.

6) Set the Homing Type

Pn 800 sets the Homing Mode. Reference section 4.3.2 of the NS300/NS500 User's Manual. The most common type is Type 1 where the load passes the Zero Input and latches position. This home type uses the Approach Speed for Homing, Pn803, and Creep Speed for Homing, Pn804. Step 5 above sets the Approach Speed for Homing. The Creep Speed, Pn804, is usually acceptable at the default level of 500 [1000 R.U./ minute].

If any other type of homing is used, The Feed Speed for Zero Point Return, Pn802 will also need to be set.

7) Set the status of the hardware overtravel limit switches.

Pn819 determines whether the overtravel is enabled, bit 0, and whether the input is normally open or normally closed, bit 1. The default value of Pn819 is 1, which is the hexadecimal value of bits 0 and 1. The default value enables the positive and negative overtravel and sets them to normally closed.

Pn81A determines the stopping action once the load contacts the limit switch. The default value of Pn81A is 0 for turning the Servo Off – Base Block. Some applications might benefit in setting this parameter to 1 which is Hard Stop. A Hard Stop decelerates the load at maximum torque and keeps the servo enabled.

Pn001.1 sets the Servo Off and Alarm Stop mode. The default value is 0 for Dynamic Brake Stop. Therefore, if Pn81A is set to 0, and the load contacts a limit switch the servo will turn off and the motor will be stopped and held by the dynamic brake circuit.

8) Set the Status of the EMSTOP input.

Pn81B determines whether the EMSTOP is enabled, bit 0, and whether the input is normally open or normally closed, bit 1.

Bit	Value	Meaning
0	0	Disabled
0	1	Enabled
1	0	N.C.
1	1	N.O.

The default value of Pn81B is 1, which is the hexadecimal value of bit 0 and bit 1. This value enables the EMSTOP input and sets the input to normally closed.

If the EMSTOP input is not used, set the value of PN81B to 0 – EMSTOP disabled.

9) Set the Positioning Deadband.

Pn850 sets a position deadband. The deadband is a range of Reference Units around the target position that the NS300 will consider the move completed. Setting this window too small will cause the NS300 to never reach final position. The value of the PN850 should be set to the accuracy required for the final position of the index move. Once the NS300 has positioned within the deadband, the INPOS bit in the DeviceNet response message will be set to 1.

10) Set the Following Error Limit.

The Overflow Level, Pn505, sets a maximum following error in units of [256 R.U.]. If this value is exceeded the SGDH/NS300 will issue an A.DO Alarm and the servo will be disabled. Set this value large enough to avoid nuisance trips but large enough so that the servo will trip if there is a mechanical jam.

11) Set the Step Distance for using STEP mode.

The STEP mode indexes the motor to a value stored in the parameters.

Step Distance 1 is stored in Pn844 in Reference Units.

Step Distance 2 is stored in Pn845 in Reference Units.

Step Distance 3 is stored in Pn846 in Reference Units.

Step Distance 4 is stored in Pn847 in Reference Units.

12) Set Tuning Parameters.

Proportional Gain for Position	Pn102
Proportional Gain for Speed	Pn100
Integral Time Constant for Speed	Pn101
Inertia Ratio	Pn103
Feed Forward	Pn109
On-Line Autotuning	Pn110
Torque Reference Time Constant	Pn401
Notch Filter On/Off	Pn408
Notch Filter Frequency	Pn409

Refer to Chapter 6 of the SGDH user manual for details on tuning.

13) Set the Brake Output

A brake output is only required on vertical axis in which a brakemotor is used to hold the load from shifting due to gravity. The software function of each electrical output must be allocated. The default allocation does not include a Brake. The settings required to allocate the Brake function can be found in section 6.4.3 of the NS300/500 user manual.

Pn50E = 3001

Pn50F = 0200

For details on Brake timing, refer to section 6.5.2 of the NS300/500 user manual.

14) Perform a System Reset

Perform a System Reset to save parameters to non-volatile memory. A System Reset can be performed by choosing Reset from the System menu in NSxxx software or by using the SET/READ command messages. The SET/READ command messages include a Unit Reset Command. Details of the SET/READ command messages are in section 5.3.4 of the NS300/500 user manual.