Mechatronics
NS600

Quick reference

OMRON

Quick reference:
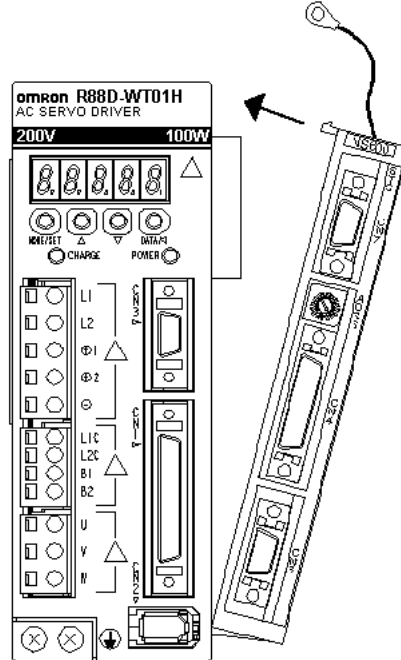# NS 600

THIS MANUAL CONTAINS:

1- NS600 Installation

Follow this step to install the NS600 board onto a W series servo.

1. - Take out the bus connector protector from the W series servo driver, this protector is at right side of the driver.
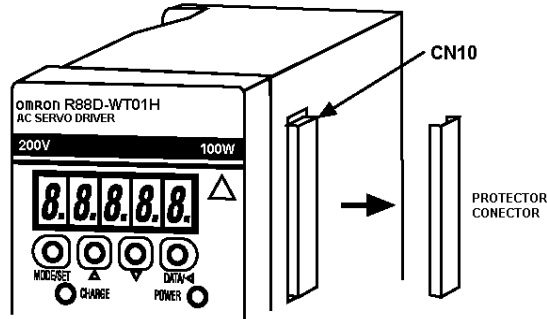
2. -Insert the lower clamps of the board into the holes on the bottom of the driver. (Right side)

3. - Pull the board following the arrow direction, an insert the top clamp onto the hole.

4. - To ground the board is necessary to use an Philips screw M3x10 up to 1 kW, M4x10 up to 5KW and M4x8 up to 15KW. Connect the cable with the G point on the servo driver and clamp it with the screw.

Up to 5KW   Up to 15KW

NS600 positioning board

STS: Status Led (green, red)

CN7: (RS422) Configuration and maintenance connector: **Digital operator**

ADRS: Axis address (0 – F)

CN3: (RS232C) Wmon connector

CN4: I/O Connector (sequence)

CN1: I/O Connector (sequence)

CN6: (RS232C, RS422, RS485) serial command connector: **PC o control device**
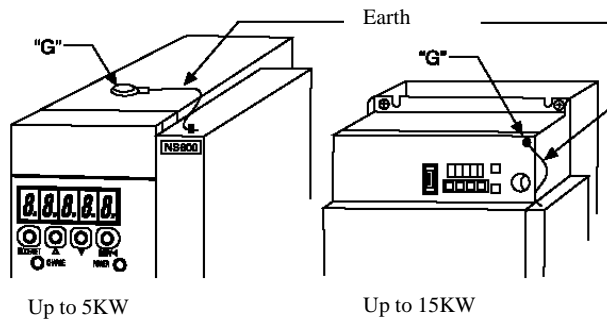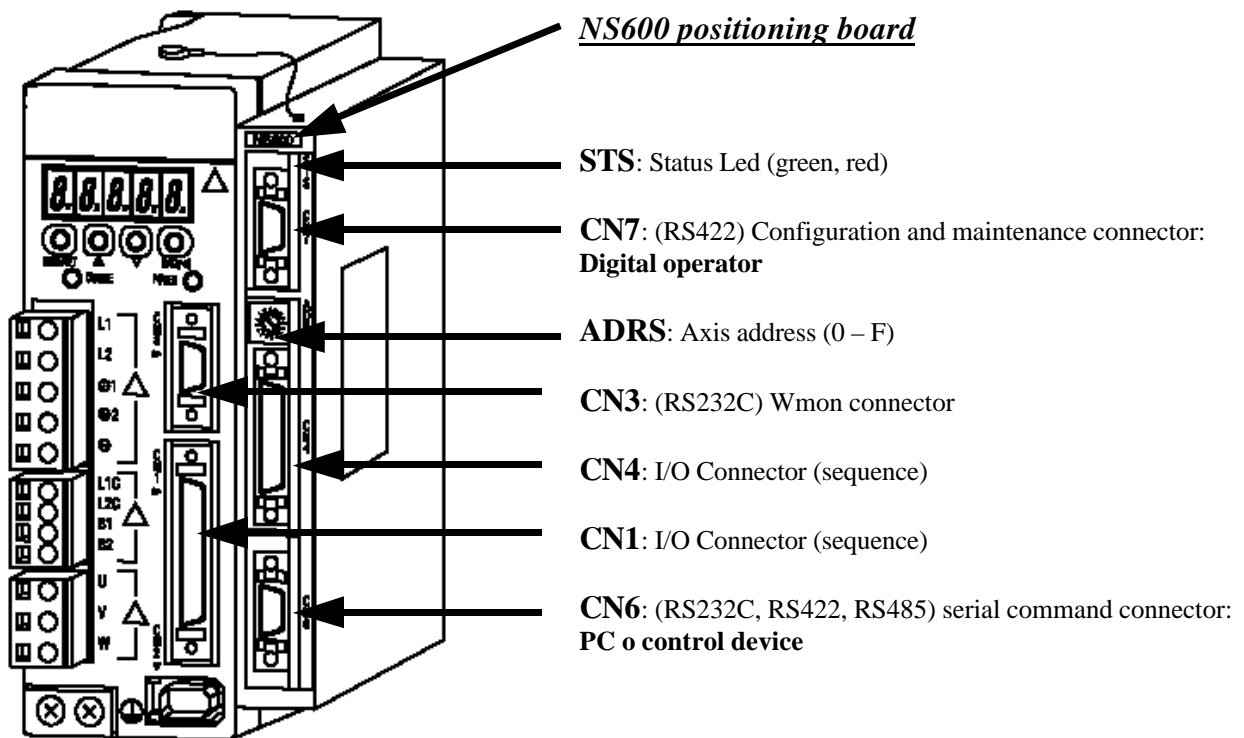
The different connectors reference are:

14 PINS RIGHT ANGLE RECEPTACLE	COM CN7, CN3, CN6
50 PINS RIGHT ANGLE RECEPTACLE	COM CN1
36 PINS RIGHT ANGLE RECEPTACLE	COM CN4

The cable configuration to connect the board with the INDEXWORK software is as follows
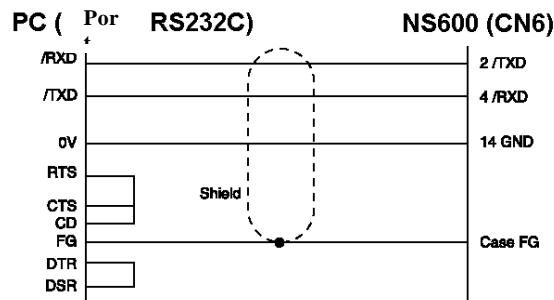
Maximum length 3 meters

2- Configuration

Connecting the NS600 board with the servo driver makes that some of driver characteristics change:

- PARAMETERS: Many of servo drivers parameters loss his utility (for example, the speed and torque control parameters, because this board always work in position control) and also some new features are added (for example, Pn823: origin search function, etc..)

- INPUTS / OUTPUTS: In the same way, some input disappears and new specific ones appear. It's not possible to configure the inputs and both driver (CN1) and board (CN4) are fixed.

- DIGITAL OPERATOR: When the NS600 board is connected the driver display goes down and if a digital operator is needed is should be connected to CN7 connector of the NS600 board. But if for some time the communication between the driver and the NS600 stops the display will flash again.

2.1. - INPUTS / OUTPUTS

CN1 connector (SERVODRIVER)

INPUTS

CN1-47		+24VIN Input common. Is necessary an external 24 V power supply for the inputs.
CN1-40	RUN	Servo enables input. (Servo ON when ON)
CN1-41	(NOT USED)	
CN1-42	POT	Positive overtravels (Forward run prohibited when OFF).
CN1-43	NOT	Negative overtravel (Reverse Run prohibited when OFF).
CN1-44	**DEC**	**Zero point return (homing) Deceleration limit switch** (Enable when ON)
CN1-46	**RGRT**	**Registration latch.**
		When this signal is On during a positioning with a registration the registered position is being made, interrupting the original movement.

OUTPUTS

CN1-31, 32	ALM	Servo alarm output (OFF when alarm occurs)
CN1-25, 26	WARN	Servo Warning output (ON for warning)
CN1-27, 28	BKIR	Brake output (brake released when ON)
CN1-29, 30	READY	(ON when ready)
CN1-37/38/39,1	AL01/AL02/AL03	Alarm output code.

Also we can found the encoder output (line-driver).

CN4 Connector (NS600 board)

INPUTS

CN4-1		+24V/COM	Input common. External 24 V power supply is needed
CN4-3		MODE	Mode selection: mode 0 (position table) when ON or mode 1 (multispeed)
CN4-5	(mode0)	START-STOP	Start or stop the positioning.
	(mode1)	HOME	Start the origin search.
CN4-7	(mode0)	PGMRES	Reset the current position table.
	(mode1)	JOGP	Forward Jog.
CN4-9	(mode0)	SEL0	Position selection input 0.
	(mode1)	JOGN	Reverse Jog.
CN4-11	(mode0)	SEL1	Position selection input 1.
	(mode1)	JOG0	Speed selection input 0.
CN4-13	(modeo0)	SEL2	Position selection input 2.
	(mode1)	JOG1	Speed selection input 1.
CN4-15	(mode0)	SEL3	Position selection input 3.
	(mode1)	JOG2	Speed selection input 2.
CN4-17	(mode0)	SEL4	Position selection input 4.

(mode1)   JOG3   Speed selection input 3.

Depending on the Cn4-3 mode selection the rest of input will take one function or the other one.

For example: the CN4-15 will be the function SEL3 only if the mode is 0 (Input Cn-4-3 ON) in other case it will be the function JOG2

OUTPUTS

CN4-19, 20	INPOSITION	In position: Turns ON when the number of error pulses reaches the value set. The setting is the number of error pulses set in reference units (input pulse units defined by the electronic gear ratio)
CN4-21, 22	POUT0	Programmable output.
CN4-23, 24	POUT1	Programmable output
CN4-25, 26	POUT2	Programmable output.
CN4-27, 28	POUT3	Programmable output.
CN4-29, 30	POUT4	Programmable output.

2.2. - Parameters.

The new parameters that NS600 board has are present below:

Parameter Number	Name	Unit	Setting Range	Default Setting
Pn800	**Serial Communication Protocol (see note 1)**	-	0 = RS422 1 = RS422 + Echo Back 2 = RS485 Delimiter CR 3 = RS485 Delimiter CR + Echo Back per Character 4 = RS485 Delimiter CR + Echo Back per Character 5 = RS485 Delimiter CRLF 6 = RS485 Delimiter CRLF + Echo Back per Character 7 = RS485 Delimiter CRLF + Echo Back per Character	1
Pn801	**Baud rate (see note 1)**	-	0 = 9600 1 = 19200 2 = 38400	0
Pn802	Answer	-	0 = OK = No Answer 1 = OK = Answer	1
Pn803	**/MODE 0/1 (see note 1)**	-	0 = Close = Mode 0 1 = Open = Mode 0 2 = Always Mode 0 3 = Always Mode 1	0
Pn804	**/START-STOP; /HOME (see note 1)**	-	0 = Close = Program Start (Mode 0) 0 = Close = Homing Start (Mode 1) 1 = Open = Program Start (Mode 0) 1 = Open = Homing Start (Mode 1) 2 or 3 = No Program Start (Mode 0) 2 or 3 = No Homing Start (Mode 1)	0
Pn805	**/PGMRES; /JOGP (see note 1)**	-	0 = Open -> Close = Program Reset (Mode 0) 0 = Close = Jog Forward (Mode 1) 1 = Close -> Open = Program Reset (Mode 0) 1 = Close = Jog Forward (Mode 1) 2 or 3 = No Program Reset (Mode 0) 2 or 3 = No Jog Forward (Mode 1)	0
Pn806	**/SEL0; /JOGN (see note 1)**	-	0 = Close = Program Select (Mode 0) 0 = Close = Jog Reverse (Mode 1) 1 = Open = Program Select (Mode 0) 1 = Open = Jog Reverse (Mode 1) 2 = Always Program Select (Mode 0) 2 = No Jog Reverse (Mode 1) 3 = No Program Select (Mode 0) 3 = No Jog Reverse (Mode 1)	0

Parameter Number	Name	Unit	Setting Range	Default Setting
Pn807	**/SEL1; /JOG0 (see note 1)**	-	0 = Close = Program Select (Mode 0) 0 = Close = Jog Select (Mode 1) 1 = Open = Program Select (Mode 0) 1 = Open = Jog Select (Mode 1) 2 = Always Program Select (Mode 0) 2 = Always Jog Select (Mode 1) 3 = No Program Select (Mode 0) 3 = No Jog Select (Mode 1)	0
Pn808	**/SEL2; /JOG1 (see note 1)**	-	0 = Close = Program Select (Mode 0) 0 = Close = Jog Select (Mode 1) 1 = Open = Program Select (Mode 0) 1 = Open = Jog Select (Mode 1) 2 = Always Program Select (Mode 0) 2 = Always Jog Select (Mode 1) 3 = No Program Select (Mode 0) 3 = No Jog Select (Mode 1)	0
Pn809	**/SEL3; /JOG2 (see note 1)**	-	0 = Close = Program Select (Mode 0) 0 = Close = Jog Select (Mode 1) 1 = Open = Program Select (Mode 0) 1 = Open = Jog Select (Mode 1) 2 = Always Program Select (Mode 0) 2 = Always Jog Select (Mode 1) 3 = No Program Select (Mode 0) 3 = No Jog Select (Mode 1)	0
Pn80A	**/SEL4; /JOG3 (see note 1)**	-	0 = Close = Program Select (Mode 0) 0 = Close = Jog Select (Mode 1) 1 = Open = Program Select (Mode 0) 1 = Open = Jog Select (Mode 1) 2 = Always Program Select (Mode 0) 2 = Always Jog Select (Mode 1) 3 = No Program Select (Mode 0) 3 = No Jog Select (Mode 1)	0
Pn80B	**/S-ON (see note 1)**	-	0 = Close = Servo ON 1 = Open = Servo ON 2 = Always Servo ON 3 = Always Servo OFF	0
Pn80C	**P-OT (see note 1)**	-	0 = Open = Forward OT Status 1 = Close = Forward OT Status 2 = Always Forward OT Status 3 = Always Moveable	0
Pn80D	**N-OT (see note 1)**	-	0 = Open = Reverse OT Status 1 = Close = Reverse OT Status 2 = Always Reverse OT Status 3 = Always Moveable	0
Pn80E	**/DEC (see note 1)**	-	0 = Close = Zero-point Deceleration LS Start 1 = Open = Zero-Point Deceleration LS Start 2 = Always Zero-Point Deceleration LS Start 3 = No Zero-Point Deceleration LS Start	0
Pn80F	**/RGRT (see note 1)**	-	0 = Close = Registration Start 1 = Open = Registration Start	0
Pn810	**/INPOSITION (see note 1)**	-	0 = Close = Positioning is Complete 1 = Open = Positioning is Complete	0
Pn811	**/POUT0 (see note 1)**	-	0 = Close = Active 1 = Open = Active	0
Pn812	**/POUT1 (see note 1)**	-	0 = Close = Active 1 = Open = Active	0
Pn813	**/POUT2 (see note 1)**	-	0 = Close = Active 1 = Open = Active	0
Pn814	**/POUT3 (see note 1)**	-	0 = Close = Active 1 = Open = Active	0
Pn815	**/POUT4 (see note 1)**	-	0 = Close = Active 1 = Open = Active	0
Pn816	**/WARN (see note 1)**	-	0 = Close = Error/Warning Status 1 = Open = Error/Warning Status	0
Pn817	**/BK (see note 1)**	-	0 = Close = Brake Release 1 = Open = Brake Release	0
Pn818	**/S-RDY (see note 1)**	-	0 = Close = Servo is Ready 1 = Open = Servo is Ready	0
Pn819	**Overtravel (OT) Stop Method (see note 1)**	-	0 = Servo OFF (Same as setting in Pn001.0) 1 = Emergency Stop	0

			2 = Deceleration Stop	
Pn81A	**Moving Method (see note 1)**	-	0 = Linear 1 = Rotary (Shortest Path) 2 = Rotary (Forward) 3 = Rotary (Reverse)	0
Pn81B	**P-LS Position Reference Forward Limit (see note 1)**	Reference Unit	-99999999 ~ +99999999	+99999999
Pn81C	**N-LS Position Reference Reverse Limit (see note 1)**	Reference Unit	-99999999 ~ +99999999	-99999999
Pn81D	**Home Position (see note 1)**	Reference Unit	-99999999 ~ +99999999	0
Pn80F	**/RGRT (see note 1)**	-	0 = Close = Registration Start 1 = Open = Registration Start	0
Pn810	**/INPOSITION (see note 1)**	-	0 = Close = Positioning is Complete 1 = Open = Positioning is Complete	0
Pn811	**/POUT0 (see note 1)**	-	0 = Close = Active 1 = Open = Active	0
Pn812	**/POUT1 (see note 1)**	-	0 = Close = Active 1 = Open = Active	0
Pn813	**/POUT2 (see note 1)**	-	0 = Close = Active 1 = Open = Active	0
Pn814	**/POUT3 (see note 1)**	-	0 = Close = Active 1 = Open = Active	0
Pn815	**/POUT4 (see note 1)**	-	0 = Close = Active 1 = Open = Active	0
Pn816	**/WARN (see note 1)**	-	0 = Close = Error/Warning Status 1 = Open = Error/Warning Status	0
Pn817	**/BK (see note 1)**	-	0 = Close = Brake Release 1 = Open = Brake Release	0
Pn818	**/S-RDY (see note 1)**	-	0 = Close = Servo is Ready 1 = Open = Servo is Ready	0
Pn819	**Overtravel (OT) Stop Method (see note 1)**	-	0 = Servo OFF (Same as setting in Pn001.0) 1 = Emergency Stop 2 = Deceleration Stop	0
Pn81A	**Moving Method (see note 1)**	-	0 = Linear 1 = Rotary (Shortest Path) 2 = Rotary (Forward) 3 = Rotary (Reverse)	0
Pn81B	**P-LS Position Reference Forward Limit (see note 1)**	Reference Unit	-99999999 ~ +99999999	+99999999
Pn81C	**N-LS Position Reference Reverse Limit (see note 1)**	Reference Unit	-99999999 ~ +99999999	-99999999
Pn81D	**Home Position (see note 1)**	Reference Unit	-99999999 ~ +99999999	0
Pn81E	**Positioning/Registration Speed (see note 1)**	X1000 Reference Unit/min.	1 ~ 99999999	1000
Pn81F	Acceleration	X1000 Reference Unit/min/ms.	1 ~ 99999999	1000
Pn820	Deceleration	X1000 Reference Unit/min/ms.	1 ~ 99999999	1000
Pn821	/INPOSITION Width	Reference Unit	1 ~ 99999	1
Pn822	Near Width	Reference Unit	1 ~ 99999	1

Pn823	Homing Method	-	0 = No Homing 1 = /DEC and C-phase 2 = /DEC only 3 = C-phase only	0
Pn824	Homing Direction	-	0 = Forward 1 = Reverse	0
Pn825	Homing Moving Speed	x1000 Reference Unit/min.	1 ~ 99999999	1000
Pn826	Homing Approach Speed	X1000 Reference Unit/min.	1 ~ 99999999	1000
Pn827	Homing Creep Speed	X1000 Reference Unit/min.	1 ~ 99999999	1000
Pn828	Homing Final Move Distance	Reference Unit	-99999999 ~ 99999999	0

Note 1: Parameters Pn800, Pn801, Pn803-Pn81E (parameters in bold) are offline parameters. After changing these offline parameters, cycle power (or send serial command RES) to enable the new setting.
Pn802, Pn81F, Pn820, Pn821, Pn822, Pn824, Pn825, Pn826, Pn827, Pn829, are online parameters
(Parameters not in bold). New settings become effective immediately.

Servo Driver parameters

Category	Parameter Number	Name	Unit	Setting Range	Default Setting
Function Selection Parameters	**Pn000**	**Function Selection Basic Switches** (See note 3)	—	—	0010
	Pn001	**Function Selection Application Switches 1** (See notes 1 and 3)	—	—	0000
	Pn002	**Function Selection Application Switches 2** (See note 3)	—	—	0000
	Pn003	Function Selection Application Switches 3	—	—	0002
Gain Parameters	Pn100	Speed Loop Gain	Hz	1 to 2000	40
	Pn101	Speed Loop Integral Time Constant	0.01ms	15 to 51200	2000
	Pn102	Position Loop Gain	s^{-1}	1 to 2000	40
	Pn103	Inertia Ratio	%	0 to 10000	0
	Pn104	Not Used	—	—	—
	Pn105	Not Used	—	—	—
	Pn106	Not Used	—	—	—
	Pn107	Bias	Rpm	0 to 450	0
	Pn108	Bias Width Addition	Ref. units	0 to 250	7
	Pn109	Feed-forward	%	0 to 100	0
	Pn10A	Feed-forward Filter Time Constant	0.01ms	0 to 6400	0
	Pn10B	**Gain-related Application Switches** (See note 3)	—	—	0000
	Pn10C	Mode Switch Torque Reference	%	0 to 800	200
	Pn10D	Mode Switch Speed Reference	Rpm	0 to 10000	0
	Pn10E	Mode Switch Acceleration	10rpm/s	0 to 3000	0
	Pn10F	Mode Switch Error Pulse	Ref. units	0 to 10000	0
	Pn110	**Online Autotuning Switches** (See note 3)	—	—	0010
	Pn111	**Speed Feedback Compensation** (See note 2)	%	1 to 100	100
	Pn112		%	0 to 1000	100
	Pn113		—	0 to 10000	1000
	Pn114		—	0 to 400	200
	Pn115		—	0 to 1000	32
	Pn116		—	0 to 1000	16
	Pn117	Reserved parameters (Do not change)	%	20 to 100	100
	Pn118		%	20 to 100	100
	Pn119		s^{-1}	1 to 2000	50
	Pn11A		0.1%	1 to 2000	1000
	Pn11B		Hz	1 to 150	50
	Pn11C		Hz	1 to 150	70
Gain Parameters	Pn11D		%	1 to 150	100
	Pn11E		%	1 to 150	100
	Pn11F		ms	1 to 2000	0
	Pn120	Reserved parameters (Do not change)	0.01 ms	1 to 51200	0
	Pn121		Hz	10 to 250	50
	Pn122		Hz	0 to 250	0
	Pn123		%	0 to100	0

Position Parameters	**Pn200**	**Position Control Reference Selection Switches** (See note 3)	—	—	0000
	Pn201	**PG Divider** (See note 3)	p/r	16 to 16384	16384
	Pn202	**Electronic Gear Ratio (Numerator)** (See note 3)	—	1 to 65535	4
	Pn203	**Electronic Gear Ratio (Denominator)** (See note 3)	—	1 to 65535	1
	Pn204	Not Used	—	—	—
	Pn205	**Multi-turn Limit Setting** (See notes 1 and 3)	rev	0 to 65535	65535
	Pn206	Not Used	—	—	—
	Pn207	**Position Control Function Switches** (See note 3)	—	—	0001
	Pn208	**Position Reference Movement Averaging Time** (See note 3)	0.01ms	0 to 6400	0
Speed Parameters	Pn300	Not Used	—	—	—
	Pn301	Not Used	—	—	—
	Pn302	Not Used	—	—	—
	Pn303	Not Used	—	—	—
	Pn304	Not Used	—	—	—
	Pn305	Not Used	—	—	—
	Pn306	Not Used	—	—	—
	Pn307	Not Used	—	—	—
	Pn308	Speed Feed-Forward Filter Time Constant	0.01ms	0 to 65535	0
Torque Parameters	Pn400	Not Used	—	—	—
	Pn401	Torque Reference Filter Time Constant	0.01ms	0 to 65535	100
	Pn402	Forward Torque Limit	%	0 to 800	800
	Pn403	Reverse Torque Limit	%	0 to 800	800
	Pn404	Not Used	—	—	—
	Pn405	Not Used —	—	—	
	Pn406	Not Used	—	—	—
	Pn407	Not Used	—	—	—
	Pn408	Torque Function Switches	—	—	0000
	Pn409	Notch Filter Frequency	Hz	50 to 2000	2000
Sequence Parameters	Pn500	Not Used	—	—	—
	Pn501	Not Used	—	—	—
	Pn502	Rotation Detection Level	rpm	1 to 10000	20
	Pn503	Not Used	—	—	—
	Pn504	Not Used	—	—	—
	Pn505	Overflow Level	256 ref.units	1 to 32767	1024
	Pn506	Brake Reference Servo OFF Delay Time	10ms	0 to 50	0
	Pn507	Brake Reference Output Speed Level	rpm	0 to 10000	100
	Pn508	Timing for Brake Reference Output during Motor Operation	10ms	10 to 100	50
	Pn509	Momentary Hold Time	ms	20 to 1000	20
	Pn50A	Input Signals Selection 1	—	—	8881 (fixed)
	Pn50B	Input Signals Selection 2	—	—	8888 (fixed)
	Pn50C	Input Signals Selection 3	—	—	8888 (fixed)
	Pn50D	Input Signals Selection 4	—	—	8888 (fixed)
	Pn50E	Output Signals Selection 1	—	—	3000 (fixed)
	Pn50F	Output Signals Selection 2	—	—	1200 (fixed)
	Pn510	Output Signals Selection 3	—	—	0000 (fixed)
	Pn511	Reserved (do not change)	—	—	8468 (fixed)
	Pn512	Output Signals Reversal Settings	—	—	0000
Other Parameters	Pn600	Regenerative Resistor Capacity (See note 4)	10 W	0 to capacity (See note 5)	0
	Pn601	Reserved parameter (Do not change)	—	0 to capacity (See note5)	0

Notes:
1. The multiturn limit is valid only when parameter Pn002.2 Absolute Encoder Usage is set to "2". The value will be processed in the range of "+32767 to -32768" for other settings even if the value is changed. There is no need to change the multiturn limit except for in special cases. Be careful not to change the setting unless necessary.
2. The setting of parameter Pn111 is valid only when parameter Pn110.1 is set to 0.
3. Offline parameters in bold: After changing these parameters, cycles the main circuit and control power (or send serial command RES) to enable the new settings.
4. Normally set to "0". When using an external regenerative resistor, set the capacity (W) of the regenerative resistor.
5. The upper limit is the maximum output capacity (W) of the servo amplifier.

Regarding the monitor parameters the structure is as follows.

- Between Un000 and Un00D there is no difference but Un001 (speed command) has been eliminated, also Un005 and Un006 has been modified (because Inputs and outputs has change)
- The new monitor added are Un800 to Un811

Digital Operator (CN7)	Content of Display	Unit	Equivalent Serial Command (CN6)
Un800	Last Error	—	ERR
Un801	NS600 Input Signal Monitor	—	IN2
Un802	NS600 Output Signal Monitor	—	OUT2
Un803	Status Flag Monitor	—	STS or MON6
Un804	Current Issue Position Monitor	reference units	PUN or MON1
Un805	Current Motor Position Monitor	reference units	PFB or MON7
Un806	Target Position Monitor	reference units	POS or MON8
Un807	Target Distance Monitor	reference units	DST or MON9
Un808	Registration Target Position Monitor	reference units	RPOS or MON10
Un809	Registration Target Distance Monitor	reference units	RDST or MON11
Un80A	Program PGMSTEP Pass through Monitor	—	PGMSTEP
Un80B	Program EVENT Lapse Time Monitor msec	—	EVTIME
Un80C	Program LOOP Pass through Monitor	—	LOOP
Un80D	Serial Command Receipt Letter Trace	—	None
Un80E	Serial Command Receipt Letter (Number of Letters)	—	None
Un80F	Serial Command Transmission Error Letter (Number of Letters)	—	None
Un810	Serial Command Transmission Letter Trace	—	None
Un811	Serial Command Transmission Letter (Number of Letters)	—	None

Finally we have the same for the auxiliary functions:

- From Fn000 to Fn014 some functions has been eliminated (Fn009, Fn00A and Fn00B)
- And some new ones has been added from Fn800 a Fn808

Digital Operator (CN7)	Function	Equivalent Serial Command (CN6)
Fn800	NS600 software version display	VER
Fn801	NS600 type code (0600H) display	TYPE
Fn802	NS600 Y spec. no. Display	YSPEC
Fn803	Program table save	PGMSTORE
Fn804	ZONE table save	ZONESTORE
Fn805	JOG speed table save	JOGSTORE
ALARM RESET Button	Alarm Reset	ARES
Fn806	Program table initialisation	PGMINIT
Fn807	ZONE table initialisation	ZONEINIT
Fn808	JOG speed table initialisation	JSPDINIT

3- working modes

There are two different modes to operate the board:

- Program table mode
- Serial commands mode.

3.1.- Program table mode.

In this mode the NS600 works using the parameters stored in form of tables (program, zones and jog) stored into memory. To program this table the INDEXWORKS software is needed.

Working in this mode is also possible to select mode 0 or mode 1 by a digital input CN4-3. In mode 1 we can work with multispeed (up to 16 jog speeds) and also make and origin search (homing). In mode 0 we can select between several positionings stored into a table.

3.1.1.- MODE 1

3.1.1.1.- Jog speed table operation.

With the programming software INDEXWORK, is possible to program a table with 16 speeds (JSPD0 to JSPD15) and depending on the status of digital inputs JOG0/JOG1/JOG2/JOG3 is possible to select any of them. Also is possible to select the rotation direction by the signals JOGP for forward movement or JOGN for reverse operation.
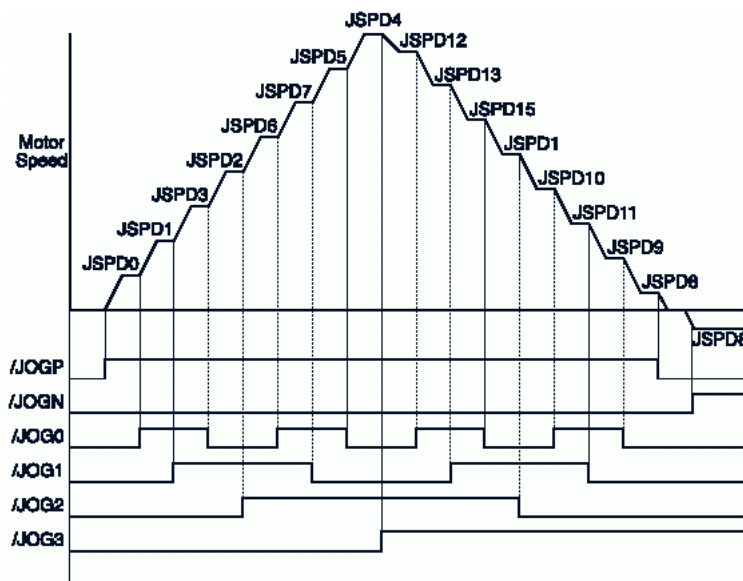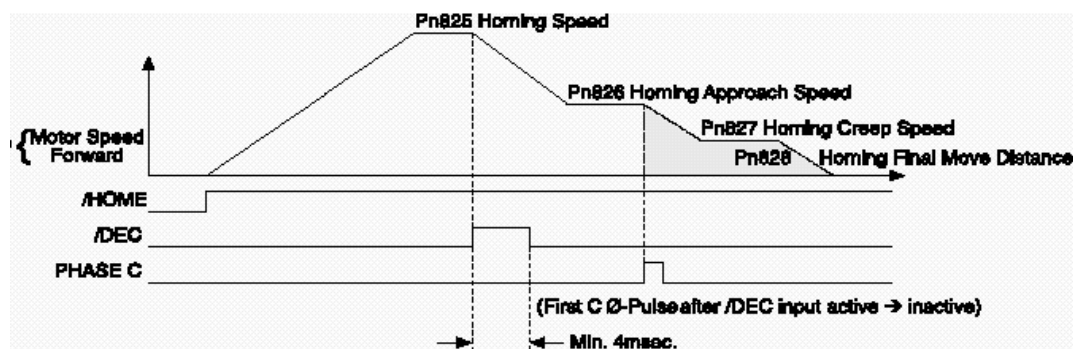

All the jog speeds are stored into the NS600 memory table and the inputs could be programmed in the parameters Pn-805 to Pn-80A. (Only activation level because the pin number is fixed)

NOTE: (It works in the same way that multispeeds in the inverters)

3.1.1.2.- HOMING operation (origin search)

There are three types of origin search, the most complete one is the mode 1:

When the HOME signal turns ON the origin search starts in the direction specified by Pn824 at homing speed marked by parameter Pn825. When the DEC signal is detected the speed is reduced to the homing approach speed (Pn826) and after the detection of first C phase pulse the servo will move the homing final move distance (Pn828) at homing creep speed (Pn827).

To perform this operation a 1 should be written into parameter Pn823, the other values 2 and 3 correspond to next methods:

2-Use only the DEC signal, the operation will starts at homing approach speed and on the rising edge of DEC signal the final positioning will be performed.

3-Use only the Z pulse signal, the operation also starts at homing approach speed and at first rising edge of C phase the final positioning will be performed.

Writing 0 in the parameter Pn823 will disable the HOMING function.

The used parameter for this function goes from Pn824 to Pn828, with the Pn805 and Pn80E used to define the activation level of DEC and HOME inputs.

3.1.2.- MODE 0

3.1.2.1.- Program table mode.

The NS600 can store up to 128 position tables using the option INDEX in the programming software INDEXWORK. With the digital inputs SEL4/SEL3/SEL2/SEL1/SEL0 (Selection) is possible to select the first positioning that should be performed when the START/STOP signal goes on. While the Start signal is ON the several positionings will be performed following the table. If Start signal goes OFF the action would be interrupted and will restart at the interrupted positioning when Start signal turns ON again.

When the PGMRES (program reset) turns ON while the START/STOP signal is disconnected, the register were the current table position is stored will be cleared. So if any interrupt occurs before use the PGMRES input the operation will restart at table position marked by inputs (SEL4/SEL3/SEL3/SEL1/SEL0) not were the movement was interrupted.

Pay attention that only is possible to select between the first 32 table positions with the digital inputs.

- Program table (INDEX) or positioning

This table contents up to 128 positions (0 to 127) and every position is divided into 9 fields.

PGM STEP	POS	SPD	RDST	RSPD	POUT	EVENT	LOOP	NEXT
0	A+100000	1000	250000	1000	NNNAA	IT0	1	1
1	I-200000	200	400000	2000	NNAA:	SEL3	2	127
2	+Infinite	4000	-	3000	ZZZZZ	IT1000	1	2
3	I+300000	500	-	4000	NA: ZZ	DT500	3	END
4	Stop	3000	-	5000	: : : : :	IT0	2	END
…	…	…	…	…	…	…	…	…
127	-	1000	100000	4000	AA: ZZ	IT0	5	END

PGM STEP: Position number (0 a 127)

POS: Positioning type

> I +/- 99999999 Relative position reservation   + or –.
> A +/-99999999 Absolute position reservation + or -.
> +Infinite   Equivalent to jog forward.
> -Infinite   Equivalent to jog reverse.
> Stop   Stops positioning.
> -   No movement. Used to activate POUT.

Default settings is Stop

SPD: Speed Reservation setting (1 to 99999999 x 1000 units/min).
                 Default sets 1000.

RDST: Registration (Relative) Position reservation
                 (0 to 99999999 units) Default setting – (without positioning).

RSPD: Registration speed reservation. (1 – 99999999 x 1000 units/min).
                 Default sets 1000.

POUT: While the positioning is performed the digital outputs will be activated and is possible to program the function. POUT4/POUT3/POUT2/POUT1/POUT0
> N   doesn't activate.
> A   active output.
> Z   Check the zone table and active the output is table if zone is empty.
> :   Maintain status.

Default setting :::::
If any output should be active after one positioning is complete use – in POS field.

EVENT: Condition that should be accomplished before to go next step or to repeat the positioning. NEXT or LOOP in the

> I   Continues when the INPOSITION or INP1 (PN821) turns ON
> N   Continues when the NEAR or INP2 (Pn822) turn ON
> D   Continues when the DEN (commanded position completed) turns ON
> SELx   Continues when the digital input SEL0/…/SEL4 turn ON
> Tx   Continues x milisecons after the positioning has begin.

All the items could be combined with the Tx where x= 0 to 99999 ms. Then is possible to obtain ITx, NTx,DTx, SELx.
Default setting is IT0

LOOP:
Repeat program step specified number of time (1 to 99999) before to start next step.
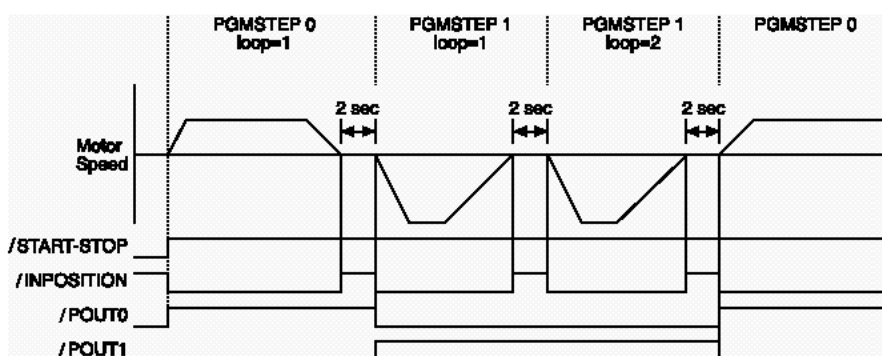Default value 1

NEXT: Indicates what will be the next step to be executed (1 to 127), also is possible to mark that this step is the last with the END selection.
Default setting is END

Example:

PGMSTEP	POS	SPD	RDST	RSPD	POUT	EVENT	LOOP	NEXT
0	I+200000	15000	-	1000	NNNNA	IT2000	1	1
1	I-200000	30000	-	1000	NNNAN	IT2000	2	0

In this example the START-STOP signal is turn ON with the positioning number 0 selected by SEL4/SEL3/SEL2/SEL1/SEL0 inputs (all inputs OFF):

- Incremental positioning of 20000 units in forward direction (POS = I+20000) with a speed of 15000 x 1000 units/min (SPD = 15000), output POUT0 is active during positioning (POUT=NNNNA).
- When the first positioning has finished, and 2 seconds afterwards the INP signal goes ON (EVENT=IT2000) the positioning number 1 will start (LOOP =1 → no repeat, NEXT = 1).
- Incremental positioning of 200000 units in reverse direction (POS = I-200000) with a speed of 30000 x 1000 units/min (SPD = 30000), output POUT1 is active during positioning (POUT = NNNAN), in this case the POUT0 output activated before is turn OFF.
- When the second positioning has finished, and 2 seconds afterwards the INP signal goes ON (EVENT=IT2000), afterwards the positioning will be repeated one time (LOOP=2 → repeat 2 times).
- Incremental positioning of 200000 units in reverse direction (POS = I-200000) with a speed of 30000 x 1000 units/min (SPD = 30000), output POUT1 is active during positioning (POUT = NNNAN)
- When the second positioning has finished, and 2 seconds afterwards the INP signal goes ON (EVENT=IT2000) the positioning number 0 will starts (LOOP=2 → has been executed 2 times, NEXT=0)
- The cycle starts from beginning.

3.2.- Serial commands

In this mode the NS600 works executing the orders that arrive by the CN6 com. Up to 16 devices can be connected in this way, using RS-422 or RS-485 (Pn800).

The protocol used is ASCII 7 bits for data, 1 stop bit, even parity and with configurable speeds (9600, 19200 or 38400) by parameter Pn801

Next command format should be used:

Axis Nº		Command character line		CR
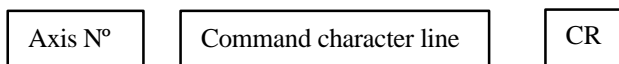
Where the axis number correspond with the ADRS switch (o to F) or * if command should be send to all the slaves.

EXAMPLE:

1SVON [CR]	Axis 1 goes to Servo ON (run)
2SVON [CR]	Axis 2 goes to Servo ON (run)
1SPD2000 [CR]	Axis 1 speed for positioning is defined as 2000 x 1000 units/min
2SPD1000 [CR]	Axis 2 speed for positioning is defined as 1000 x 1000 units/min
1POS15000 [CR]	Axis 1 positioning defined as absolute in forward direction and 15000 units
2POS-10000 [CR]	Axis 2 positioning defined as absolute in reverse direction and 10000 units
*ST	Both axis starts positioning at the same time

Parameter Pn802 allows to configure if the NS600 will answer or not to this commands. If answer is enable the message will have this format.

Axis Nº		Command character line		CR		LF
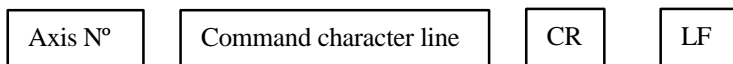
EXAMPLE:

Positive answer:

 1OK[SP][SP][SP][SP][SP][SP][SP][SP][SP][CR][LF]

Negative answer:

 1E56E[SP]ERR[SP]SN[CR][LF]

Where 56 is the error code.

Command types:

 There are many different types of commands:

- **Basic operation**: SVON (servo ON), SVOFF (servo OFF), ARES (reset alarm), RES (reset board).

- **Movement commands**: POS/POSA (absolute position), POSI (relative position), SPD (speed), ACC (acceleration), DEC (deceleration), ST (positioning start), STA (absolute positioning start), STI (relative positioning start), RDST (Registration distance reservation), RSPD (registration speed reservation), RS (positioning start with registration), RSA (absolute positioning start with registration), RSI (relative positioning start with registration), POUT (POUT reservation), JOGP (Jog forward), JOGN (jog reverse), RJOGP (forward jog with registration), RJOGN (reverse jog with registration), ZRN (Homing), ZSET (coordinates setting), HOLD (positioning interruption), SKIP (positioning stop)

- **Parameter operation command**: PRM (read parameter), PRM= (writer parameter), TRM= (temporary parameter write), PRMINIT (parameter initialisation)

- **Program table set-up commands**: PGMINIT (program initialisation), ZONEINIT (ZONE table initialisation), JSPINIT (JOG speed table initialisation), PGMSTORE, ZONESTORE, JSPSTORE (program, ZONE, SPEED table save), POST, SPDT,RDST, RSPDT POUTT, EVENTT, LOOPT, NEXTT, (program table POS read), POST=, SPDT=, RDST=, RSPDT=, POUTT=, EVENTT=, LOOPT=, NEXTT=, (program table POS write), ZONEPT, ZONENT (positive and negative zone position limit read), ZONEPT=, ZONENT= (positive and negative zone position limit write), JSPDT (Jog table read), JSPDT= (Jog table write)

- : START (Program operation start), STOP (program operation interruption), PGMRES (program reset)

- **Monitors and functions**: ALM (alarm or warning read), ERR (error read), IN1 (Servodriver input signal monitor), IN2 (NS600 input signal monitor), POUT (POUT monitor), OUT1 (Servodriver output signal monitor), OUT2 (NS600 output signal monitor), MON1-11 (monitor read), PGMSTEP (read current program step N°), EVTIME (program EVENT lapse of time monitor read), LOOP (program LOOP pass through monitor read), etc..

4- programming software (INDEXWORK)

4.1.- First steps

When the program starts it ask to open one project (file). If is the first time to work in a project press "cancel" then select "file" and "new project" to create one. Afterward the project is open or created we have this window.
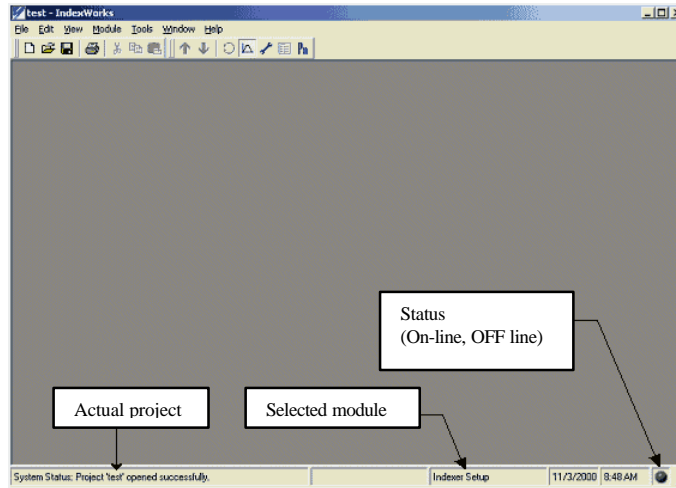
1.-First step is connect with the NS600, to do it is necessary connect the PC with the CN6 connector on the NS600. Select "Tools" and "communications settings" according to the settings in Pn800, Pn801, Pn802 and rotary switch in the NS600. Default setting in NS600 is RS422+echo back, 9600bps and slave number 0.
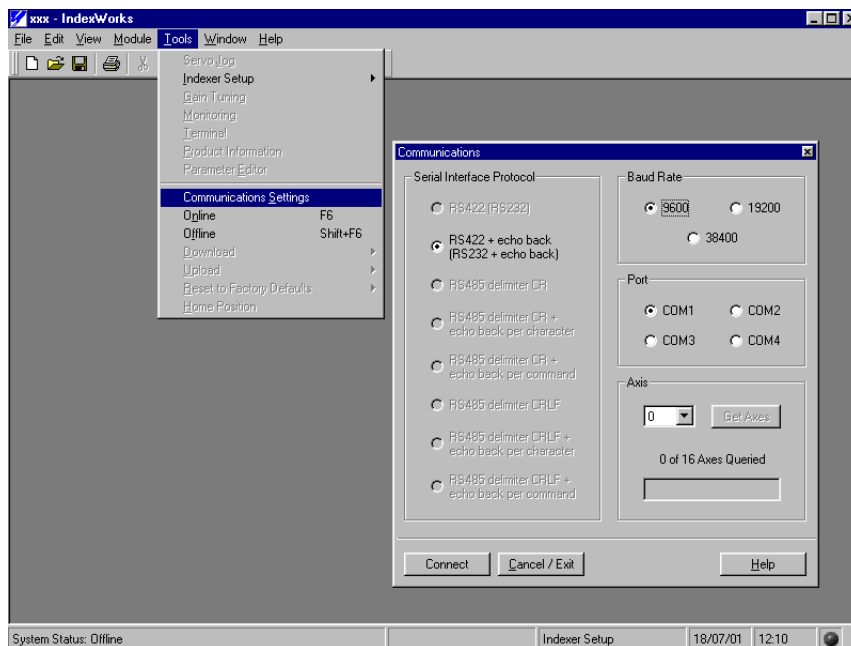
Press "connect", if communication has been established a green led will appear on the right bottom of the screen, the status will so "Online" and the servodriver model also will appear.
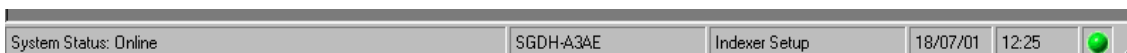

Selection "Tools" and "online" has the same effect.

TO ALLOW COMMUNICATION USING THE CN6 COM IN RS232 IS NECESSARY TO SELECT THE PORT IN "RS422" OR "RS422+ECHO BACK" IN PARAMETER Pn800.

2.- Next step is to do a TEST RUN to check the wiring between the servodriver and servomotor and verify the communication between the NS600 and the computer.

To do it selects "MODULE", "TEST RUN" and then open "TOOLS" and "SERVO JOG"
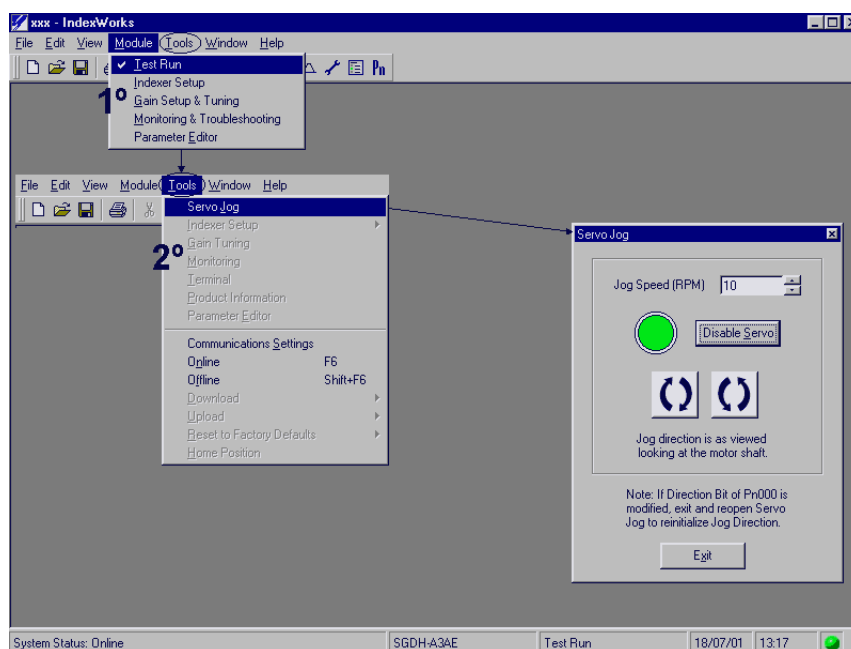
On the servo jog window is possible to activate or deactivate the servo (green led indicates servo run). Also is possible to select the jog speed and maintaining press any of the two buttons the motor will turn in forward or reverse direction.

If pressing any of this buttons the next message appear:

> "Error initiating servo jog! Moving Disable Error due to P-OT"
> "Error initiating servo jog! Moving Disable Error due to N-OT"

It means that P-OT, N-OT or both (CN1-42, CN1-43) inputs are active, it's necessary to disable them by hardware or by software in parameter Pn80C, Pn80D (option 3: movements always enable)

4.2.- WORKING WITH THE SOFTWARE

Depending on the select module is possible to operate some function or another ones. These modules are accessible by the "MODULE MENU" or in the task bar, to view these ones go to "VIEW", "TOOLBAR" and "MODULE".

Pn

       Parameter Editor
       Edit all the parameter in the servodriver and NS600. To do it is necessary to open the edit window
       ("TOOLS" and "PARAMETER EDITOR")

       NOTE: the values in blue are Selection parameters (bits) and the black ones are useful adjustments.
       Grey parameter can't be modified (fixed by NS600)

When the modification is done is necessary to use the Download function to transfer it to the servodriver and NS600
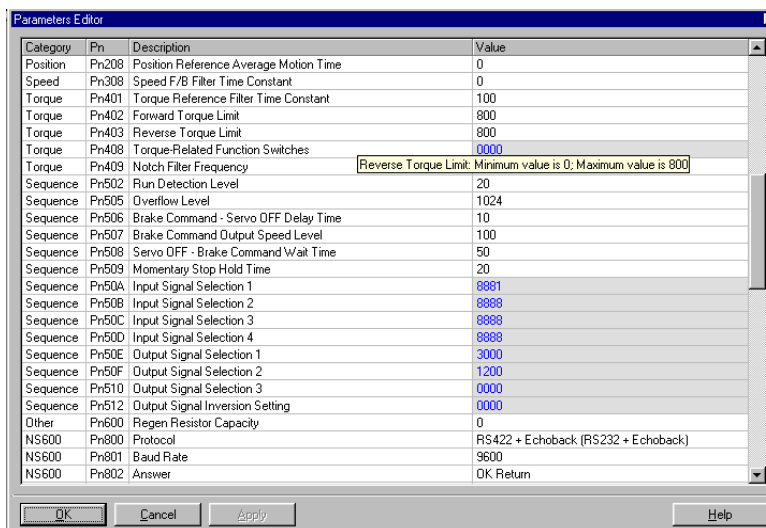
Monitoring and troubleshooting

In this module is possible to see 3 windows:
-_Terminal_: Allows serial communication with the NS600 (serial command mode)
-_Product information_: Gives information about model and characteristics of the NS board, servodriver, servomotor and encoders connected.
- _Monitor_: Open a window in which is possible to check the I/O status and the alarms.
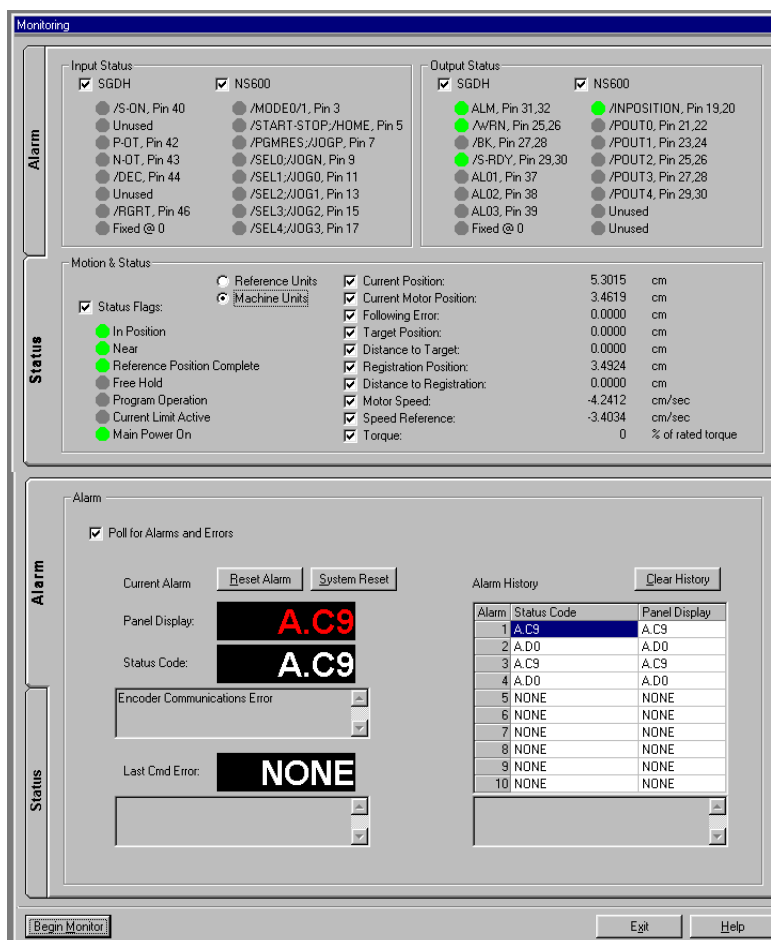
To open this window select "TOOLS", "MONITOR", "PRODUCT INFORMATION" or "TERMINAL"

Gain Setup and tuning
With this one is possible to setup the servodrivers parameters related with gains.

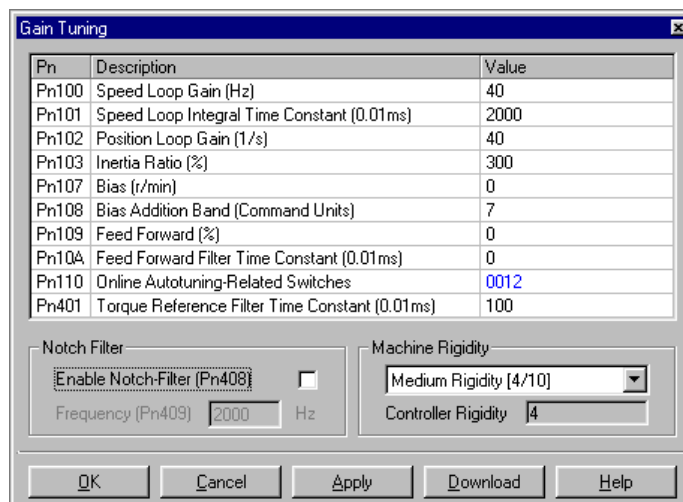| Pn	Description	Value
Pn100	Speed Loop Gain (Hz)	40
Pn101	Speed Loop Integral Time Constant (0.01ms)	2000
Pn102	Position Loop Gain (1/s)	40
Pn103	Inertia Ratio (%)	300
Pn107	Bias (r/min)	0
Pn108	Bias Addition Band (Command Units)	7
Pn109	Feed Forward (%)	0
Pn10A	Feed Forward Filter Time Constant (0.01ms)	0
Pn110	Online Autotuning-Related Switches	0012
Pn401	Torque Reference Filter Time Constant (0.01ms)	100

Notch Filter
Enable Notch-Filter (Pn408)
Frequency (Pn409) 2000 Hz

Machine Rigidity
Medium Rigidity [4/10]
Controller Rigidity 4

OK   Cancel   Apply   Download   Help

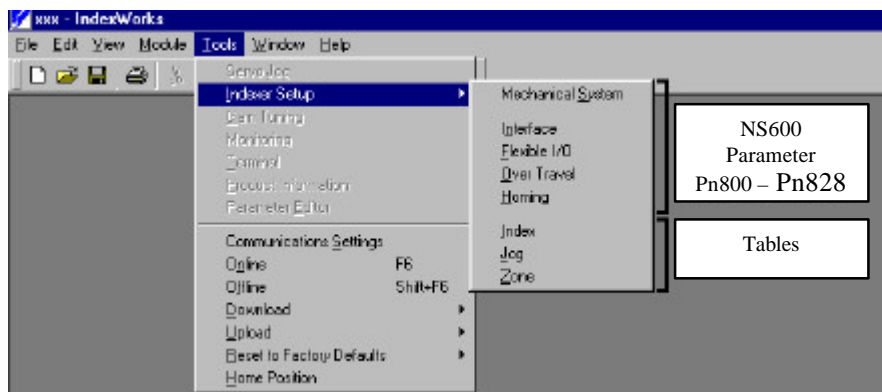To open these window select "TOOLS" and "GAIN TUNING"

Test Run
Allows some manual movements to check the wiring and serial communications.
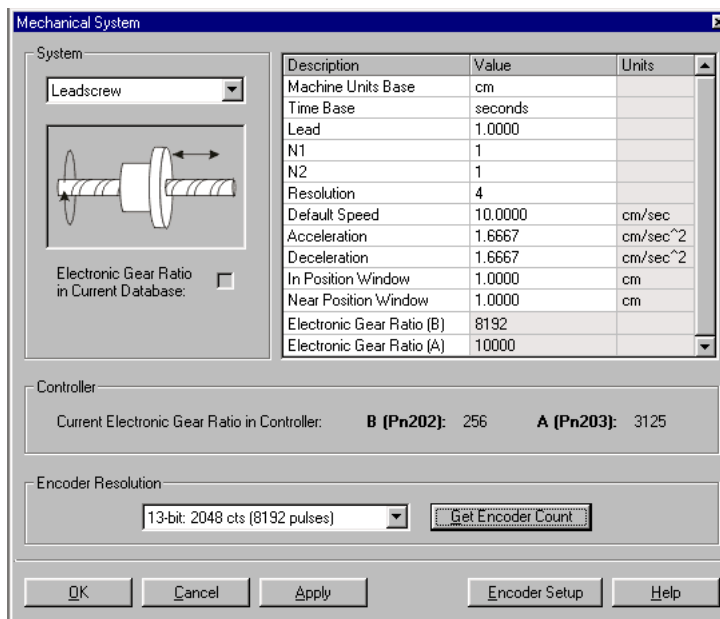
Indexer Setup
With this option is possible to setup the mechanical system, the program table, the jog table and the zone table. The inner parameters of the NS600 are divided into families.

NS600
Parameter
Pn800 – Pn828

Tables

To open it select "TOOLS" and "INDEXER SETUP" then select one of the options.

4.3.- NS600 SETUP

4.3.1.- MECHANICAL SYSTEM.

On this window is possible to setup the mechanical system, the units to work (cm, inch,deg,..), selecting the associated mechanical system the NS600 could calculate the ration between the user units and encoder pulses (pulse rate).

Parameters:

1.- Mechanical system selection (System): Leadscrewm, tangential/belt drive, material feeder, rotary table or another system.

2.- Setting up the mechanical system.
- **Machine Units Base**: mm, cm, inch, pie, degrees or rad; also the **Time base** in seconds or minutes.
- **Resolution:** fix the number of decimals (1 to 4) we will work in ($1 \times 10^{-resolution}$).
- Mechanical: **lead**, **pitch diameter, feed roll diameter**, **modulus** or another. Attention: this value should be set with 5 digits including decimals (resolution)
- **N1/N2**: indicates the reduction ratio.

With all these data the software calculates the PULSE RATE that should be introduced into servodriver's parameters Pn202 and Pn203.

3.-Another parameters:

- **Default speed**   (Pn81E)
- **Acceleration**   (Pn81Fn)
- **Deceleration**   (Pn820)
- **In Position Window**   (Pn821 INP o INP1)
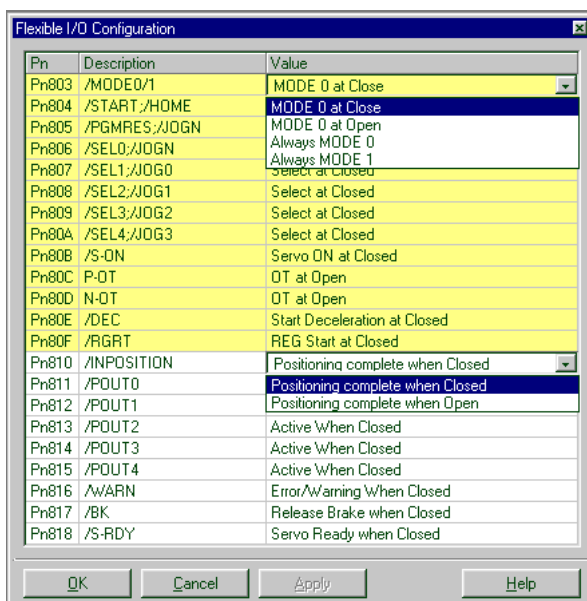- **Near Position Window**   (Pn822 NEAR o INP2)

All this parameters has as a units the defined before.

4.3.2.- INTERFACE or communication COM CN6.

Pn	Description	Value
Pn800	Protocol	RS422 + Echoback (RS232 + Echoback)
Pn801	Baud Rate	9600
Pn802	Answer	OK Return
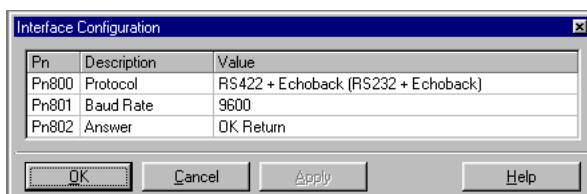
INDEXWORK works with an RS422+Echoback (RS232+Echoback) protocol and always need that NS600 responds, so parameters Pn800 and Pn802 can't be modified by the software, only the Pn801 the communication speed.

4.3.3.- FLEXIBLE I/O

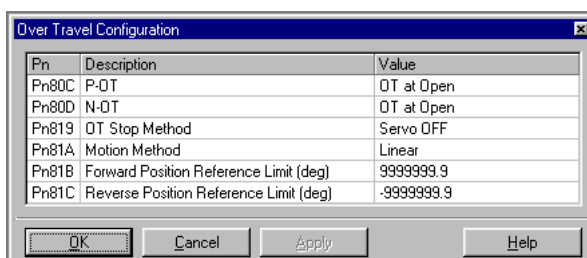| Pn	Description	Value
Pn803	/MODE0/1	MODE 0 at Close
Pn804	/START;/HOME	MODE 0 at Close
Pn805	/PGMRES;/JOGN	MODE 0 at Open
Pn806	/SEL0;/JOGN	Always MODE 0
Pn807	/SEL1;/JOG0	Always MODE 1
Pn808	/SEL2;/JOG1	Select at Closed
Pn809	/SEL3;/JOG2	Select at Closed
Pn80A	/SEL4;/JOG3	Select at Closed
Pn80B	/S-ON	Servo ON at Closed
Pn80C	P-OT	OT at Open
Pn80D	N-OT	OT at Open
Pn80E	/DEC	Start Deceleration at Closed
Pn80F	/RGRT	REG Start at Closed
Pn810	/INPOSITION	Positioning complete when Closed
Pn811	/POUT0	Positioning complete when Closed
Pn812	/POUT1	Positioning complete when Open
Pn813	/POUT2	Active When Closed
Pn814	/POUT3	Active When Closed
Pn815	/POUT4	Active When Closed
Pn816	/WARN	Error/Warning When Closed
Pn817	/BK	Release Brake when Closed
Pn818	/S-RDY	Servo Ready when Closed

Here is possible to select the activation level of all the inputs (yellow) and outputs (white) of the servodriver (CN1) and the NS600 (CN4)
The inputs could be normally open, normally close, always enable or always disable; the outputs could be normally open or normally close.
Parameters Pn803 to Pn818.

4.3.4.- OVERTRAVEL

| Pn	Description	Value
Pn80C	P-OT	OT at Open
Pn80D	N-OT	OT at Open
Pn819	OT Stop Method	Servo OFF
Pn81A	Motion Method	Linear
Pn81B	Forward Position Reference Limit (deg)	9999999.9
Pn81C	Reverse Position Reference Limit (deg)	-9999999.9

In this windows is possible to setup all the parameters related with the hardware limits (inputs POT and NOT) and also with software limits.
On hardware limits is possible to setup de inputs POT and NOT (Pn80C and Pn80D) and also how the servodriver will react when this inputs become active (Pn819 = OT stop method): servo off (free running), emergency stop or deceleration to stop.
The software limits (Pn81B and Pn81C) should give an alarm message when the actual position become greater than any of them.

The Pn81A parameter, motion method, defines if the movement will be linear (with limits) or rotative, only forward, only reverse or both.

4.3.5.- HOMING or origin search
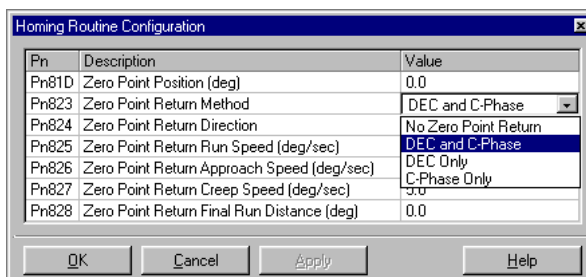
With this window is possible to setup all the parameters needed for the origin search or HOMING (Pn81D,and Pn823 to Pn828): different homings speeds, final run distance, search direction, operation method (without return, only C phase, only DEC input, or DEC input plus C phase).

4.3.6.- INDEX TABLE.
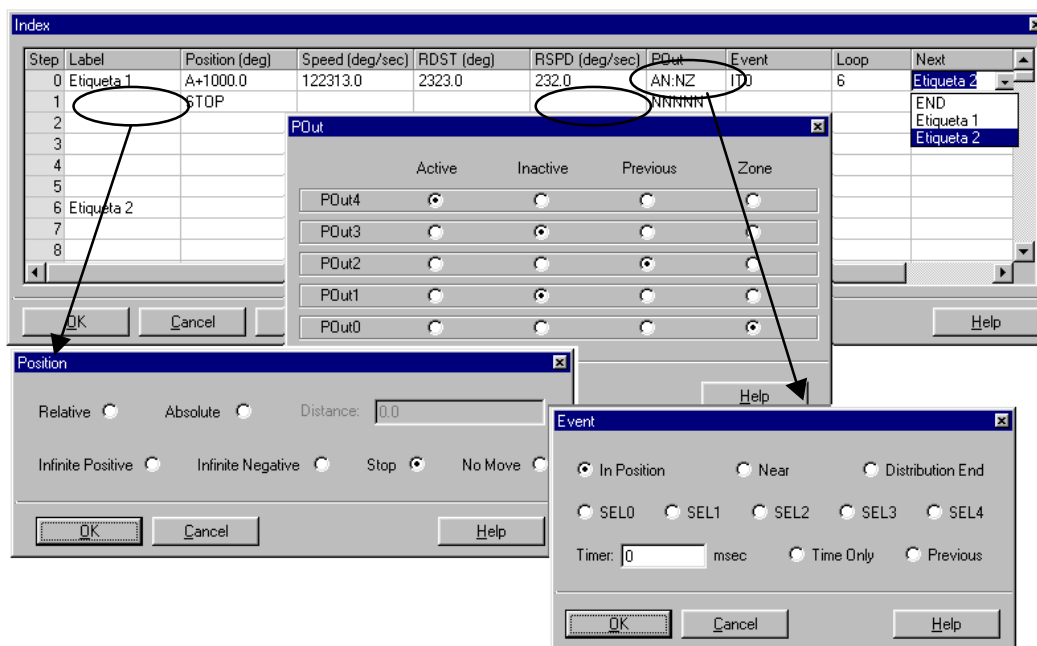
On this table 128 positionings are defined to be stored into the NS600. The software helps the user to fulfil the information needed to complete the sequences, some windows appear to do it. Also there is the possibility of use labels instead of number to help the user to fulfil the NEXT field.

4.3.7.- JOG or speed table
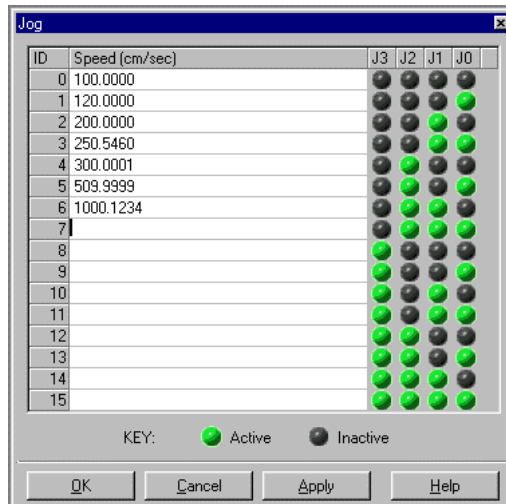
In this table up to 16 jog speeds are defined, as it has been connected at the beginning of this guide this speeds are accessible in mode 1 using the digital inputs JSPD3,JSPD2,JSPD1,JSPD0 and also the direction by JOGP and JOGN.

4.3.8.- ZONE.
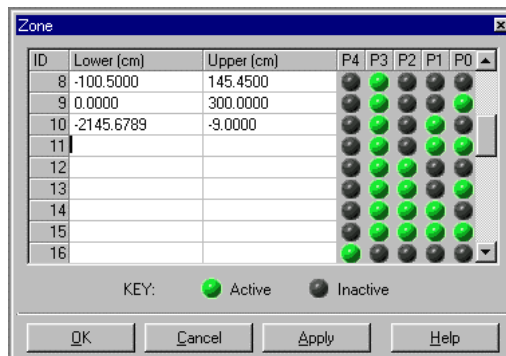
When the actual position is between the lower and upper limit of the zone, the outputs defined in this table will be activated but in the actual positioning the POUT field should be Zone, in other case the zones outputs will not be activated.

If upper limit = lower limit, the zone is inactive

In case of overlap zones, only the low number zone will be active, zone 0 has priority over all the other zones.

4.4.- UPLOAD / DOWNLOAD

In the task bar "TOOLS" there are several option that will be enabled when some modules are selected "INDEXER SETUP", "GAIN SETUP & TUNING" OR "PARAMETER EDITOR", this options are:
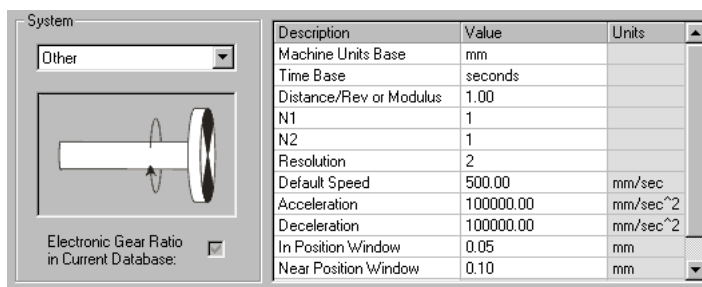
- "DOWNLOAD": This function transfers data from the INDEXWORK to the NS600 and servodriver, is possible to download all the parameters or only new ones. ("DOWNLOAD NEW")
- "UPLOAD": This function has many possibilities to transfer from NS600 or Servodriver to the INDEXWORK software. "UPLOAD ALL" parameters and tables, "ALL PARAMETERS" read only the parameters, "ALL TABLES" read only the tables, or read any family of parameters or tables selecting the desired option.

- "RESET TO FACTORY DEFAULTS" This option makes all parameters and tables return to the initial value "ALL DEFAULTS", only parameters "ALL PARAMETERS", only the tables "ALL TABLES" or any of the tables.

5- Programming example

PROGRAM TABLE

Steps:

    1.-Connect with INDEXWORK software. Create a new project and establish communication (ONLINE)

    2.- Make a TEST RUN to check the wiring and communications. Be sure that POT and NOT signal are not active to allow the movement.

    3.- Reset to default.

    4.- Mechanical system definition:

System: Other / Electronic Gear Ratio in Current Database: ☑		
Description	Value	Units
Machine Units Base	mm	
Time Base	seconds	
Distance/Rev or Modulus	1.00	
N1	1	
N2	1	
Resolution	2	
Default Speed	500.00	mm/sec
Acceleration	100000.00	mm/sec^2
Deceleration	100000.00	mm/sec^2
In Position Window	0.05	mm
Near Position Window	0.10	mm

With this one the mechanical systems is defined in mm as units, seconds and a pulse ratio of 1mm/rev

    5.- Parameter setup

- FLEXIBLE I/O → default ones

- OVERTRAVEL

Pn	Description	Value
Pn80C	P-OT	Motion Always Enabled
Pn80D	N-OT	Motion Always Enabled
Pn819	OT Stop Method	Servo OFF
Pn81A	Motion Method	Rotary(Shortest Path)
Pn81B	Forward Position Reference Limit (mm)	999999.00
Pn81C	Reverse Position Reference Limit (mm)	-999999.00

POT and NOT signals are disable, rotary movement (without software limits), and position jump from 999999 to -999999 and –999999 to 999999.

- HOMING (Origin search) → Default setting (without origin search).

    6.- Programming table.

| Step	Label	Position (mm)	Speed (mm/sec)	RDST (mm)	RSPD (mm/sec)	POut	Event	Loop	Next
0	Pos_simple	I+10.00	1.00	-	1.00	AAANN	IT5000	1	pos_k
1	pos_k	I-30.00	30.00	-	1.00	NNNNN	IT2000	4	Indefinido
2									
3									
4									
5	Indefinido	+INFINITE	50.00	5.00	0.50	ZZZZZ	IT0	1	END
6									
7									

    6.- Zone table.

ID	Lower (mm)	Upper (mm)	P4	P3	P2	P1	P0
0							
1	-110.00	0.00	●	●	●	●	○
2	0.00	30.00	●	●	●	○	●
3	30.00	70.00	●	●	○	●	●
4			●	●	○	●	●
5	70.00	100.00	●	○	●	●	●
6			●	●	○	●	●
7	100.00	99999.00	●	○	●	●	●
8			●	○	●	●	●
9			●	○	●	●	●

7.- Download all. Transfer all to the NS600 tables and parameters

8.- When al the setup is complete we will start the positioning.
- Turn On the RUN signal (CN1-40)
- Set mode 0, mode0/1(CN4-5) = ON
- Set position to be executed. In this case position 0 so SEL4/SEL3/SEL2/SEL1/SEL0 should be OFF. Default setting was NO so it's no necessary to connect physically any input.
- The positioning starts when signal START-STOP goes ON and maintain this level. Next movement could be observed.
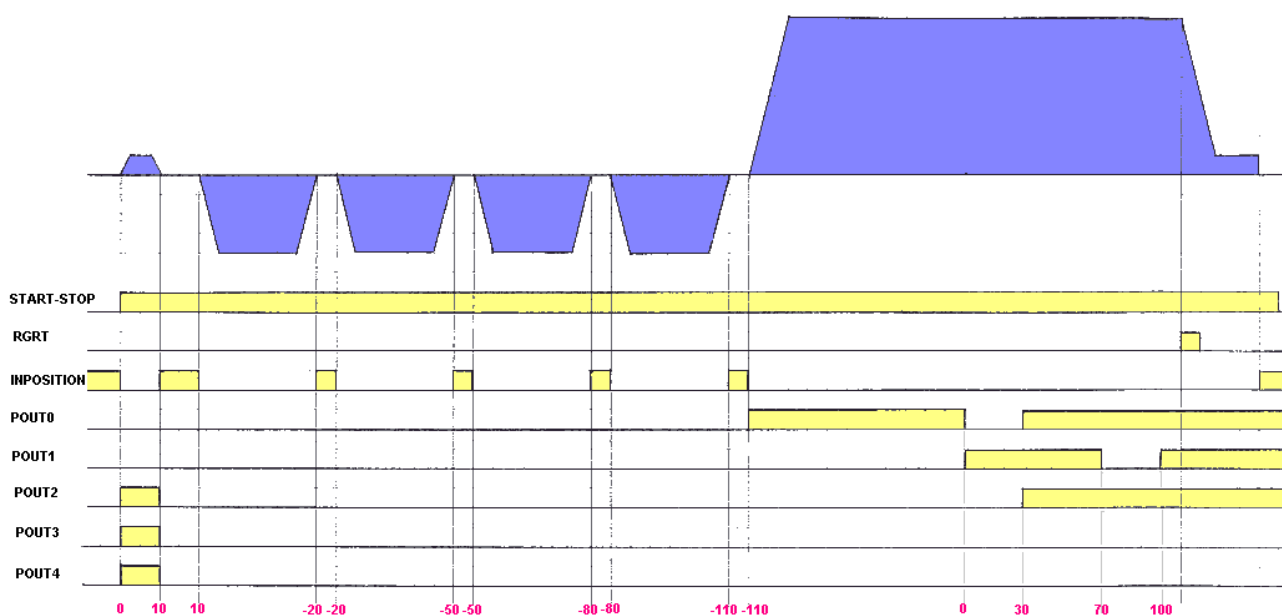
1.- First we have a relative movement of 10mm (10 revolutions due the mechanical definition) in forward direction se (POS = I+10) at 1 rev/s (SPD=1) during this positioning this outputs should be active POUT2, POUT3 y POUT4 (POUT = AAANN) . When the positioning has finished a pause of 5 seconds is made (EVENT = IT5000) before than position 1 will start (LOOP=1 y NEXT = 1)

2.- Positioning 1 starts a relative movement of 30 revolutions in reverse direction (POS=I-30) with a speed of 30 rev/s (SPD=30) during positioning all output are turn OFF (POUT = NNNNN). Like in the previous movement there is a pause of 2 seconds (EVENT = 2000) before this positioning is performed again (LOOP = 4).

3.- Positioning 1 is executed for second time (LOOP = 4) before the pause of 2 seconds.

4.- Positioning 1 is executed for third time (LOOP = 4) before the pause of 2 seconds

5.- Positioning 1 is executed for fourth time (LOOP = 4) after the pause of 2 seconds positioning 5 is executed.

6.- The 5th positioning is an infinite movement on forward direction (POS= +Infinite), meanwhile the output will be activated depending off the zone table (POUT= ZZZZZ). When the RGRT input is detected the positioning is interrupted and a registered positioning will be done. This positioning will be off 5mm in the same direction (RDST = 5) at RSPD speed. After this the positioning will be completed (EVENT= I0, LOOP= 1 y NEXT= END).