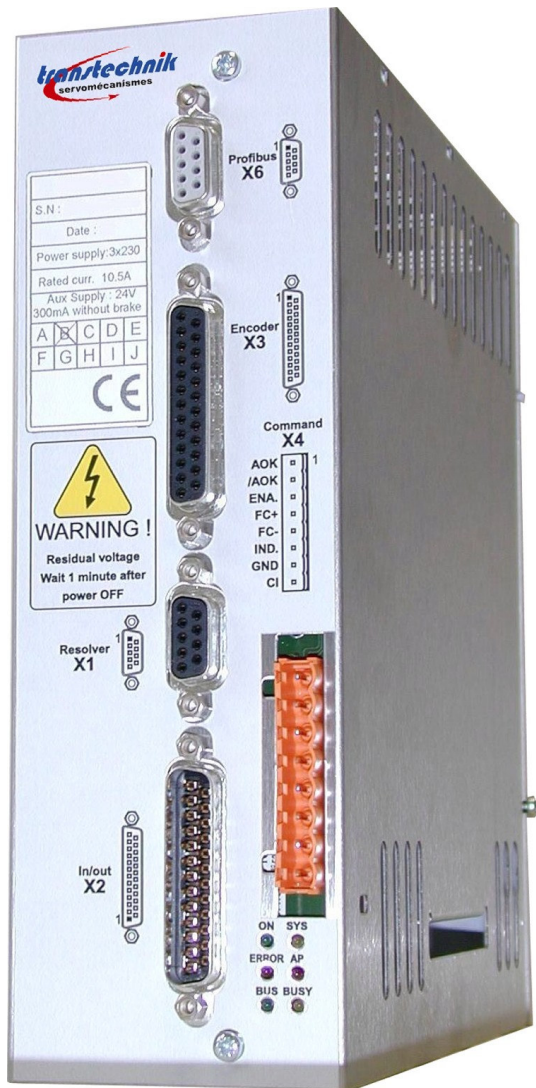


PROFIBUS Communication Profile



ServoPac-A TTA-PRO PROFIBUS Drive

WARNING

This is a general manual describing the PROFIBUS Communication Profile of the TRANSTECHNIK TTA-PRO drive (hardware release version 2.0 and firmware release from version 52B.68).

For the installation and commissioning of the drive, please refer to the appropriate manuals (**TTA-PRO Installation Guide** and **TTA-PRO User Guide**).

Instructions for storage, use after storage, commissioning as well as all technical details require the **MANDATORY** reading of the manual before getting the amplifiers operational.

Maintenance procedures should be attempted only by highly skilled technicians having good knowledge of electronics and servo systems with variable speed (EN 60204-1 standard) and using proper test equipment.

The compliance with the standards and the "CE" approval is only valid if the items are installed according to the recommendations of the amplifier manuals. Connections are the user's responsibility if recommendations and drawings requirements are not met.



Any contact with electrical parts, even after power down, may involve severe physical damage. Wait for at least 5 minutes after power down before handling the amplifiers (a residual voltage of several hundreds of volts may remain during a few minutes).

**ESD INFORMATION (ElectroStatic Discharge)**

TRANSTECHNIK amplifiers are conceived to be best protected against electrostatic discharges. However, some components are particularly sensitive and may be damaged if the amplifiers are not properly stored and handled.

STORAGE

- The amplifiers must be stored in their original package.
- When taken out of their package, they must be stored positioned on one of their flat metal surfaces and on a dissipating or electrostatically neutral support.
- Avoid any contact between the amplifier connectors and material with electrostatic potential (plastic film, polyester, carpet...).

HANDLING

- If no protection equipment is available (dissipating shoes or bracelets), the amplifiers must be handled via their metal housing.
- Never get in contact with the connectors.

**ELIMINATION**

In order to comply with the 2002/96/EC directive of the European Parliament and of the Council of 27 January 2003 on waste electrical and electronic equipment (WEEE), all TRANSTECHNIK devices have got a sticker symbolizing a crossed-out wheel dustbin as shown in Appendix IV of the 2002/96/EC Directive.

This symbol indicates that TRANSTECHNIK devices must be eliminated by selective disposal and not with standard waste.

TRANSTECHNIK does not assume any responsibility for physical or material damage due to improper handling or wrong descriptions of the ordered items.

Any intervention on the items, which is not specified in the manual, will immediately cancel the warranty.

TRANSTECHNIK reserves the right to change any information contained in this manual without notice.

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Chapter 1 - Profibus Communication

The Profibus communication is a master-slave communication. The TRANSTECHNIK® positioner is a slave positioner and the only important parameter to be defined for the communication is the amplifier address on the bus.

All other parameters (communication speed, configuration, communication parameters) are defined in the PLC (master) and will be automatically sent to the positioner:

- the available communication speeds are: 9,6 KB, 19,2 KB, 93,72 KB, 187,5 KB, 500 KB, 1,5 MB, 3 MB, 6 MB, 12 MB and will be automatically detected by the positioner.
- the configuration used will be sent to the slave at the bus start. The available configurations are PPO1, PPO2, PPO3 or PPO4,
- default parameter setting: not used by the positioner.

These various possibilities are pre-defined in a GSD file pertaining to each product range running with Profibus. The file for the TRANSTECHNIK® positioner is **INFR00C7.GSD**.

When defining the network on the master, please:

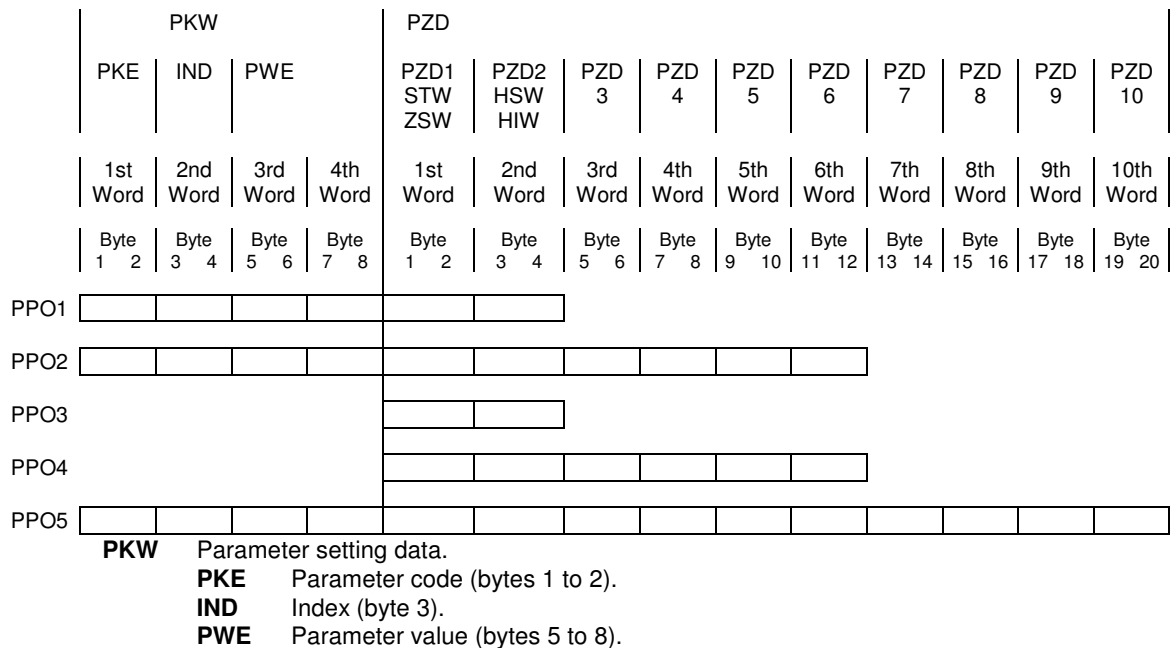
- import the slave GSD file if this has not yet been done,
- create a network with the master,
- connect a slave on the network with the same address as defined in the slave.

Note: When the communication is established, the green "RUN" LED lights up.

1 - PPO MESSAGE

In the PROFIBUS-DP communication model, a slave module consists of a certain number of inputs-outputs or input-output modules. Each module is defined by an identifier. This identifier contains information on the module direction (input, output or input-output), on the number of bytes or words and on the module consistency. The configuration is defined in the DP master and is sent to the slave by means of the Chk_Cfg function at the bus start. The slave checks if this configuration is compatible and configures itself before switching on to data exchange mode (Data_Exchange).

There is also a communication mechanism more complicated than a basic inputs/outputs identifier: the PPO (Parameter/Process data Object) messages. These messages are often used in the "device profiles". There are 5 PPO types defined for the various device profiles under Profibus:



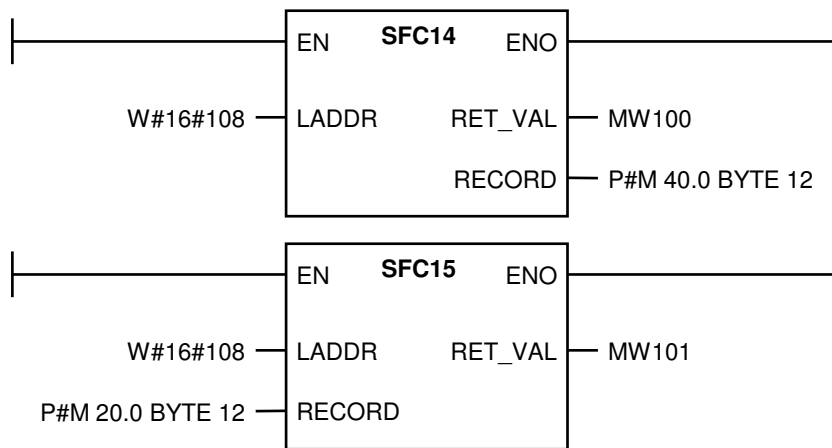
PZD	Process data (cyclically transferred).
STW	Control.
ZSW	Status.
HSW	Input command.
HIW	Information feedback.

A PPO message can contain 1 or 2 modules called PKW and PZD.

Each module (PKW or PZD) is defined as input-output and is constant over the whole module length. The communication is made by the reading or writing of PPO messages (the PKW and PZD modules are input and output at the same time). The master sends a message by a PPO-write and receives a message by PPO-read. The PPO-write and PPO-read messages are cyclically transferred by the PROFIBUS DP Data_Exchange function.

The modules are constant. This means that the different words of a same message must be transmitted or received in one single transfer. So, it is not possible to directly read or write in the PLC inputs/outputs area: special functions must be used for the data reading or writing.

Example: In the STEP7® software, the SFC14 and SFC15 functions are used for the reading and writing of the constant modules.



In the above example, the SFC14 and SFC15 functions are used for reading or writing the PZD module (PPO2 case). The W#16#108 address is the physical module address on the network that is obtained when connecting the slave to the network. This address is the same for the reading (SFC14) and writing (SFC15) because the module is an input-output module. The result of the reading will be transferred in the memory area at the address 40 by SFC14 (12 bytes). The SFC15 function will transfer the data at the address 20 (12 bytes) on the bus.

The PKW requires a SFC14 (reading) and a SFC15 (writing) and the same for the PZD.

PKW is by definition used for the positioner parameter setting and PZD is used for its operational control.

The TRANSTECHNIK® positioner uses the PPO messages mechanism for communicating by Profibus-DP.

The TTA-PRO positioners accept the PPO1, PPO2, PPO3 or PPO4 types.

2 - CONFIGURATION

Normally, the identifiers of the various PPO types are automatically provided by the GSD file. Otherwise, they can be manually defined with values indicated in the table below:

PPO type	PKW	PZD
Type 1 ReadPPO1, WritePPO1 Configuration	PKW (4 words) Inputs/outputs module 4 words Consistency 0xF3	PZD Inputs/outputs module 2 words Consistency 0xF1
Type 2 ReadPPO2, WritePPO2 Configuration	PKW (4 words) Inputs/outputs module 4 words Consistency 0xF3	PZD Inputs/outputs module 6 words Consistency 0xF5
Type 3 ReadPPO3, WritePPO3 Configuration		PZD Inputs/outputs module 2 words Consistency 0xF1
Type 4 ReadPPO4, Write PPO4 Configuration		PZD Inputs/outputs module 6 words Consistency 0xF5

Example

When PPO2 is used, the identifiers are 0xF3 and 0xF5 (4 words for PKW and 6 words for PZD).

3 - PARAMETER SETTING (PKW)

The parameter area (PKW) allows to read or modify a parameter.

3.1 – PARAMETER IDENTIFICATION (PKE)

The parameter code (PKE) is always on 16 bits:

Parameter identifier (PKE)					
Bit :	15	12	11	10	0
	AK		SPM	PNU	

Bits 0 to 10 (PNU) contain the parameter number (1 to 1999)

Bit 11 (SPM) indicates an event message: the parameter is modified and sent by the positioner

Bits 12 to 15 (AK) contain the instruction or reply code.

Instruction/Reply detail (AK)

Instruction code (master --> slave):

Instruction Code	Function	Positive reply code	Negative reply code
0	No instruction	0	
1	Read a parameter	1	7 / 8
2	Modify a parameter (word)	1	7 / 8
3	Modify a parameter (double word)	1	7 / 8

The reply code mentioned in the table above contains the normal replies associated with the instructions.

Reply codes (slave -> master):

Reply code	Function
0	No function.
1	Value of the transferred parameter (word).
1	Value of the transferred parameter (double word).
7	Instruction cannot be executed (see error code in section 3.2).
8	PKW interface inhibited.

3.2 – VALUE OF THE PWE PARAMETER

Master --> Slave

PWE includes the data for the parameter to be transferred:

- word: bytes 7 (MSB) and 8 (LSB).
- double word: bytes 5 (MSB) to 8 (LSB).

Slave --> Master

There are three possible cases regarding the slave's answer:

1st case: If the Master request concerns a reading/writing on a variable (parameter) and when this action is correctly running, the slave answers with the variable value in the PWE area.

2nd case: If the instruction requested by the master cannot be executed, the slave answers with the value 7 in the AK area and gives the error code in the PWE area:

Error code	Description
0	Illegal PNU
1	Parameter cannot be modified
2	Lower or upper limit exceeded
3	Index error
5	Incorrect data type
17	Instruction cannot be executed during the operation
18	Other error

3rd case: If the instruction requested by the master concerns a procedure (auto-tuning, auto-phasing, reading or writing in the EEPROM,...), the slaves answers with 0 in the PWE as long as the procedure is running. If the procedure has been successfully performed, the value of PWE switches to 1. If the procedure has ended with an error, PWE takes the value 2.

Note: During a procedure, the command must be maintained on the bus (and not re-started), as long as the PWE value is at 0.

IMPORTANT

Entering twice (one after the other) a same command corresponding to a procedure requires to insert a zero instruction (PKE = 0) between both instructions.

3.3 – PARAMETER SETTING EXAMPLES

Modification of a sequence parameter in the RAM memory

PKW					
AK	PKE	SPM	PNU	IND	PWE
2= word modification		0	PNU number	Sequence number	Parameter value
3= double word modification					

Example 1: modification of the sequence 2 speed value at 1000 rpm.

PKE = 0x231D (0x31D = PNU number 797)
 IND = 0x2 (sequence 2)
 PWE = 0x3E8 (1000rpm)

Example 2: modification of the sequence 5 position value at 200.

PKE = 0x331C (0x31C = PNU number 796)
 IND = 0x5 (sequence 5)
 PWE = 0xC8 (position 200)

3.4 – RULE OF THE INSTRUCTION/REPLY COMMUNICATION

- The master sends an instruction to the slave with the message "PPO write". It repeats this instruction until it gets a reply from the slave by "PPO read". This procedure guarantees the operator the instruction/reply communication.
- Just one single instruction can be executed at once.
- A slave provides the reply until the master sends a new instruction.
- An instruction (8 bytes) must be completely transferred in a message, and a reply as well.
- If no parameter setting information is required, the master must send 0 in AK (no instruction).

4 – GLOBAL CONTROL

The PROFIBUS DP global control mechanism allows the synchronization of the outputs and inputs of several modules and several slaves. There are 4 global controls: SYNC, UNSYNC, FREEZE and UNFREEZE.

When the master sends a global SYNC control, the outputs of the addressed slave are frozen at their current values. When the master sends the next data, those are stored in the slave and the outputs status remains unchanged. When the next SYNC control is sent, the stored outputs values are switched through to the outputs. An UNSYNC control can be used for ending the synchronous mode.

The FREEZE control also allows the slave to freeze the inputs at their present values and to send them with the next data transfers. The inputs are not updated until the next FREEZE control. The FREEZE mode output can be left by means of an UNFREEZE control.

The TTA-PRO positioners accept the global controls SYNC, UNSYNC, FREEZE and UNFREEZE.

Chapter 2 - Profibus Operation

1 - COMMUNICATION

The positioner is driven by Profibus with the PZD data area.

Master -> slave (PLC -> positioner):
 - Control (STW)
 - Input command (HSW)

Slave -> master (positioner -> PLC):
 - Status (ZSW)
 - Feedback (HIW)

2- POSITION MODE

2.1 – CONTROL WORD

Bit	Value	Meaning	Notes
0	1 0	ON OFF1	Enabling. Stop with ramp (PNU 765) and disabling.
1	1 0	Operational condition OFF2	Positioner ready. Disabling
2	1 0	Operational condition OFF3	Positioner ready. Emergency stop with maximum deceleration (PNU 710) and disabling.
3	1 0	Operation enabled Operation inhibited	Stop with ramp (PNU 765) and goes to Ready state
4	1 0	Operational condition for the positioner Stop	A sequence can be executed on an edge of bit 6. A positioning can be executed on a 12 or 13 bit edge. Braking with maximum deceleration (PNU 710).
5	1 0	Operational condition for the positioner Intermediate stop	Must be set at 1 for a sequence execution. Braking with programmed deceleration (PNU 765).
6	↑↓	Execute positioner function	Each edge on this bit releases the execution of the selected sequence.
7	↑	Fault acknowledgment	Positioner fault reset.
8	1 0	Jog +	Continuous motor movement in the positive counting direction.
9	1 0	Jog -	Continuous motor movement in the negative counting direction.
10	1 0	Command Local	Control by profibus Local mode control by RS-232
11	↑	Homing	Release a homing procedure on the rising edge of this bit.
12	↑↓	Absolute positioning	Each edge on this bit releases the execution of an absolute positioning.
13	↑↓	Relative positioning	Each edge on this bit releases the execution of a relative positioning.
14	1 0	Enable electronic gearing Disable electronic gearing	The motor follows the master axis position given by the position sensor connected to the second sensor input.

Note: For switching from "Profibus" mode to local mode or vice versa, the positioner must be disabled.

2.2 – INPUT COMMAND

The input command is contained in HSW (2nd word of PZD - PPO write).

For the positioner operation mode (bit 6 of the control word) PZD2 has got the following meaning.

Bits 0 to 7: number of the sequence to be executed.

Bits 8 to 15: logic inputs (bits 0 to 7). These inputs are used for the sequence start (or stop) conditions.

For the Absolute or Relative positioning (bit 12 or 13 of the control word) PZD2 is not concerned.

Position input command is contained in the PZD5 and PZD6 (if PPO2 or PPO4 are used) or in the PNU 767
 Speed is contained in the PNU 760

Acceleration is contained in the PNU 761 and Deceleration in the PNU 762

2.3 - STATUS

Bit	Value	Meaning	Notes
0	1 0	Ready for enabling Not ready	Ready for enabling (ENABLE).
1	1 0	Ready for operation	
2	1 0	Operation enabled	
3	1 0	Error	Positioner fault after error reset; is in "disabled" status.
4	1 0	No OFF2 OFF2	Instruction "OFF2" available
5	1 0	No OFF3 OFF3	Instruction "OFF3" available
6	1 0	Enabling inhibited Enabling	
7	1 0	Warning	Warning signal; the positioner goes on operating.
8	1 0	No following error Following error	
9	1 0	Operation via Profibus Operation in local mode	
10	1 0	Position is reached	Similar to the POS output.
11	1 0	Home position found	This bit is resetted in case of a feedback sensor fault. This bit is also resetted when the homing procedure is started.
12	↑ ↓	Input command acknowledgment	Acknowledgment of a sequence triggering or a manual movement
13	1 0	Motor stopped	This bit is only controlled when the "InPos" window is activated (see PNU 742 and 757).
14	1 0	Sequence running	Similar to the SEQ output.
15	1 0	Speed is reached	Similar to the SPEED output.

Note: When the motor reaches a limit switch, the following error is activated (bit 8) and the positioner fault is not activated (bit 3). The motor remains enabled.

2.4 - FEEDBACK

The feedback is included in HIW (2nd word of PZD - PPO read).

In Position mode, PZD2 has got the following meaning:

Bits 0 to 7 of the HIW: number of the running sequence (otherwise 0xFF).

Bits 8 to 15 of the HIW: programmable logic outputs (0 to 7).

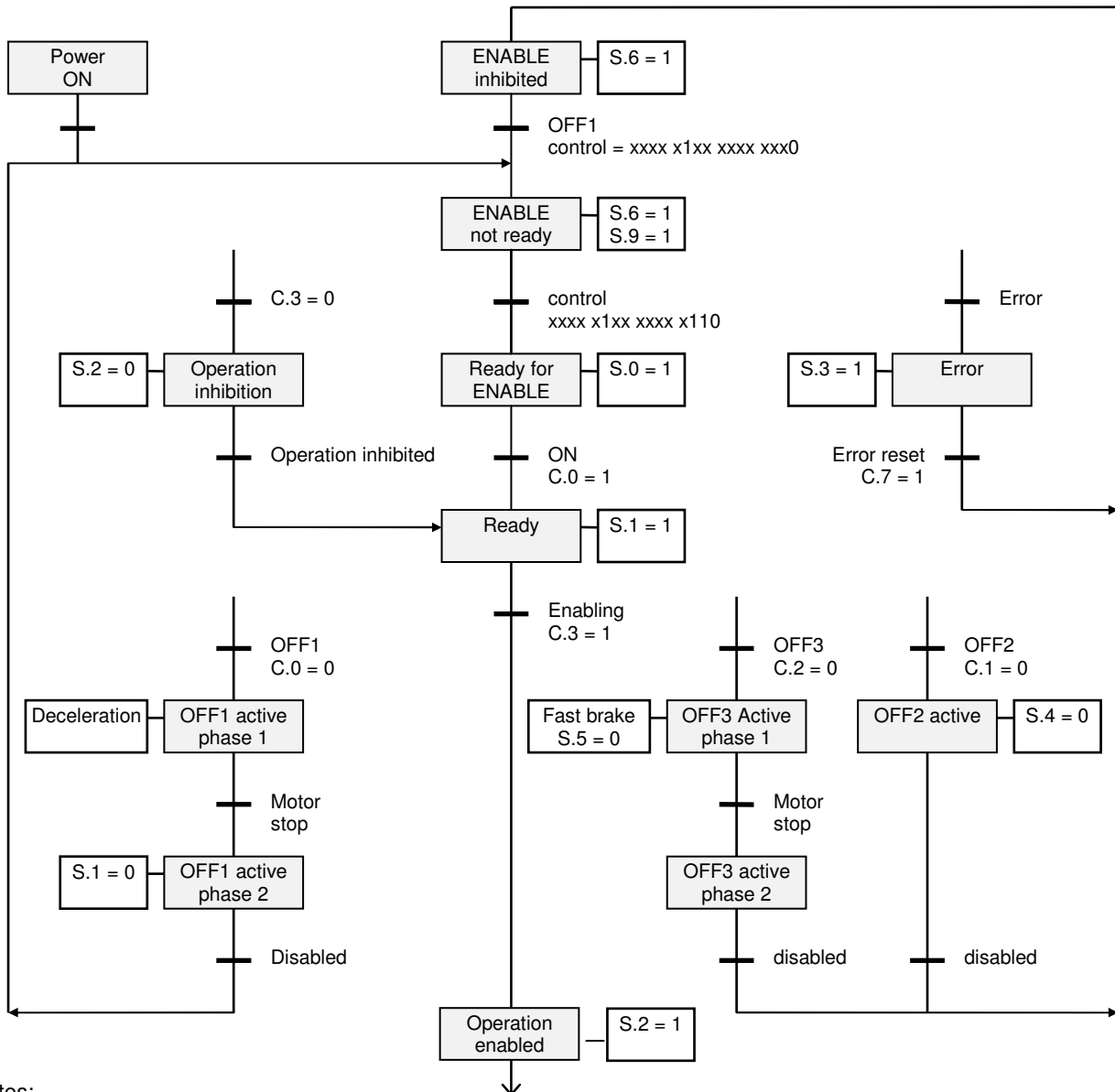
If PPO2 or PPO4 are used:

PZD3 contains the current monitor in the motor.

PZD4 contains the motor speed.

PZD5 (MSB) and PZD6 (LSB) contain the motor position.

2.5 – POSITIONER CONTROL PROCESS DIAGRAM



Notes:

- ENABLE Enabling.
- C.n Indicates bit n of the control word (see section 2.1).
- S.n Indicates bit n of the status word (see section 2.3).

This diagram describes the positioner behaviour:

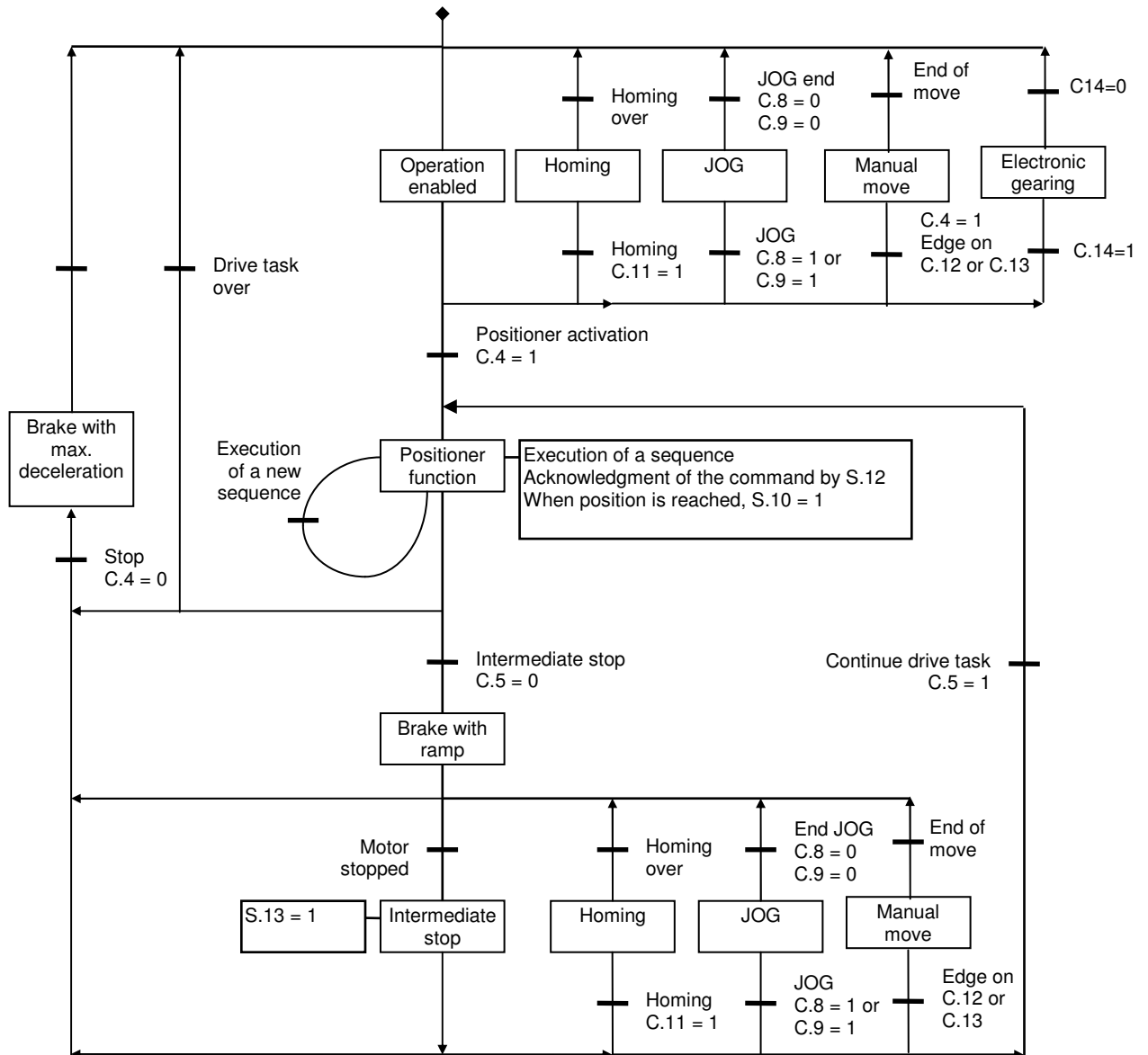
The enabling process includes 5 stages: "ENABLE inhibited", "ENABLE not ready", "Ready for ENABLE", "Ready" and "Operation enabled".

The 3 OFF1, OFF2 and OFF3 functions correspond to the various ways to disable the motor.

The functions "Error" and "OFF" are effective at each level of the diagram. "OFF3" is a stop with maximum deceleration. "OFF2" has a priority over "OFF1" which has a priority over "OFF3".

Contrarily to the parameter setting, there is no direct acknowledgment for each control word bit. The positioner status must be checked in order to make sure that the command could be executed.

2.6 – POSITIONER OPERATION DIAGRAM



When the positioner is in "Operation enabled" status, the following actions are possible:

- starting a sequence execution (bit 6),
- jog+ or jog- (bit 8 or 9),
- homing (bit 11),
- absolute positioning (bit 12),
- relative positioning (bit 13),
- electronic gearing (bit 14),
- stopping the motor with a programmed deceleration – the one defined by JOG (bit 5) -,
- stopping the motor with maximum deceleration (bit 4).

3- SPEED/TORQUE MODE

3.1 – CONTROL WORD

Bit	Value	Meaning	Notes
0	1	ON	Enabling.
	0	OFF1	Stop with ramp (PNU 723) and disabling.
1	1	Operational condition	Positioner ready.
	0	OFF2	Disabling
2	1	Operational condition	Positioner ready.
	0	OFF3	Emergency stop with maximum deceleration (PNU 710) and disabling.
3	1	Operation enabled	See the PNU 842 bit 8 for deactivation of this function *
	0	Operation inhibited	Stop with ramp (PNU 723) and goes to Ready state
7	↑	Fault acknowledgment	Positioner fault reset.
10	1	Command	Control by profibus
	0	Local	Local mode control by RS-232

* bit 3 is not operating in speed or torque mode in firmware releases lower than 529.D8

Note: For switching from the "Profibus" mode to local mode or vice versa, the positioner must be disabled.

3.2 – INPUT COMMAND

The input command is contained in HSW (2nd word of PZD - PPO write).

In speed mode, PZD2 has got the following meaning:

Speed input command on 16 bits: 0x7FFF corresponds to maximum speed.

In torque mode, PZD2 has got the following meaning:

Current input command on 16 bits: 0x7FFF corresponds to the positioner current rating.

3.3 - STATUS

Bit	Value	Meaning	Notes
0	1	Ready for enabling	Ready for enabling (ENABLE).
	0	Not ready	
1	1	Ready for operation	
	0		
2	1	Operation enabled	
	0		
3	1	Error	Positioner fault after error reset; is in "disabled" status.
	0		
4	1	No OFF2	Instruction "OFF2" available
	0	OFF2	
5	1	No OFF3	Instruction "OFF3" available
	0	OFF3	
6	1	Enabling inhibited	
	0	Enabling	
7	1	Warning	Warning signal; the positioner goes on operating.
	0		
8	1	No following error	
	0	Following error	
9	1	Operation via Profibus	
	0	Operation in local mode	
15	1	Speed is reached	Similar to the SPEED output.
	0		

3.4 - FEEDBACK

The feedback is included in HIW (2nd word of PZD - PPO read).

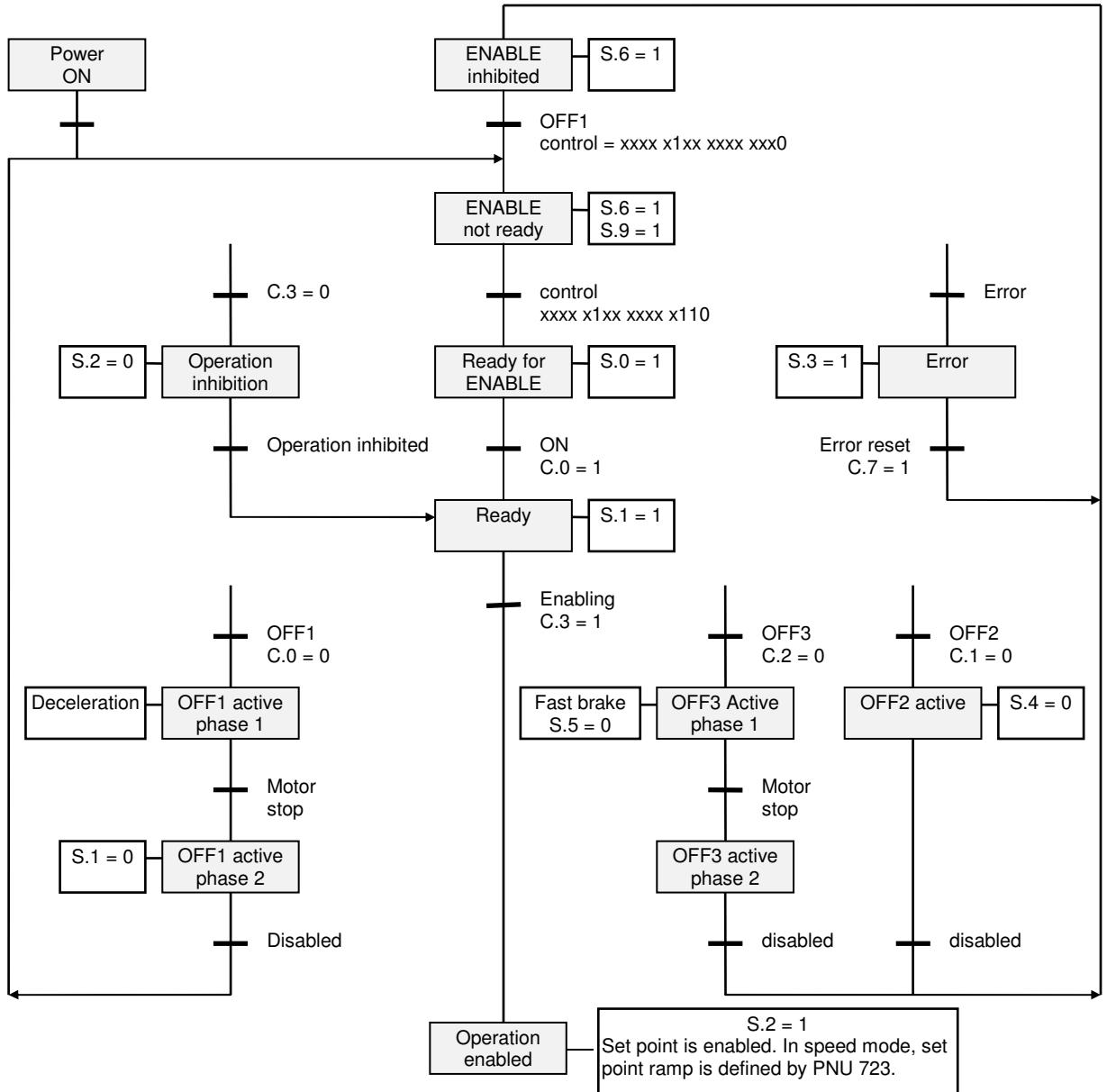
In speed mode PZD2 has got the following meaning:

Motor speed (0x7FFF corresponds to the maximum motor speed).

In torque mode, PZD2 has got the following meaning:

Motor current (0x7FFF corresponds to positioner current rating).

3.5 – OPERATION DIAGRAM



Notes:

- ENABLE Enabling.
- C.n Indicates bit n of the control word (see section 1.1).
- S.n Indicates bit n of the status word (see section 1.3).

This diagram describes the positioner behaviour:

The enabling process includes 5 stages: "ENABLE inhibited", "ENABLE not ready", "Ready for ENABLE", "Ready" and "Operation enabled".

The 3 OFF1, OFF2 and OFF3 functions correspond to the various ways to disable the motor.

The functions "Error" and "OFF" are effective at each level of the diagram. "OFF3" is a stop with maximum deceleration. "OFF2" has a priority over "OFF1" which has a priority over "OFF3".

Contrarily to the parameter setting, there is no direct acknowledgment for each control word bit. The positioner status must be checked in order to make sure that the command could be executed.

4 – DRIVING OF THE POSITIONER

4.1 – ENABLING/DISABLING

The enabling procedure is defined in the [diagram of section 2.1](#).

Example of a simplified enabling sequence in the position mode:

Stages	Communication	Value
1	PLC -> Positioner	Send control word = 0400h
2	PLC -> Positioner	Send control word = 0406h
3	PLC -> Positioner	Send control word = 0407h
4	PLC -> Positioner	Send control word = 043Fh
5	Positioner -> PLC	Check status word = xxxx xx11 xx11 0111b

Notes

- The positioner bus cycle time is 1 ms; check for at least 1 ms between 2 commands.
- In the above procedure, the positioner status is not checked at each stage but only at the end.

The disabling can be simply made by disabling one of the OFF1 or OFF2 or OFF3 bits.

4.2 – STARTING A SEQUENCE

When the positioner is in "Operation enabled" status, a sequence is started by:

- entering the sequence number in PZD 2,
- reversing bit 6 of the control word.

If a new sequence is started whereas the positioner is executing a sequence, the positioner immediately executes the new sequence without stopping the motor.

4.3 – OTHER MOVEMENTS

The other possible non programmed movements are:

- jog+ or Jog- (bit 8 or 9),
- homing (bit 11),
- absolute positioning (bit 12),
- relative positioning (bit 13).

The movements are mutually exclusive (including a sequence execution): when a movement is running, no other movement is possible.

For absolute or relative positionings, the 32 bit position input command is contained in PZD5 and PZD6.

4.4 – SPEED CONTROL

It is also possible to control the positioner in speed mode:

- switch to speed mode by means of parameter [PNU 720](#), with disabled motor. At power on, the amplifier is always in positioning mode.
- the PLC must send the speed input command in PZD2 (16 bits full scale) of the PPO-write.
- the PLC can read the motor speed monitor in PZD2 (16 bits full scale) of the PPO-read.

Remark : The speed input command can be selected from the analog input by using the [PNU 843](#).

4.5 – TORQUE CONTROL

It is also possible to control the positioner in torque mode:

- switch to torque mode by means of parameter [PNU 720](#), with disabled motor. At power on, the amplifier is always in positioning mode.
- the PLC must send the current input command in PZD2 (16 bits full scale) of the PPO-write.
- the PLC can read the motor current monitor in PZD2 (16 bits full scale) of the PPO-read.

Remark: The current input command can be selected from the analog input by using the [PNU 843](#).

5 – CHANGING THE PZD DATA

The default mapping of the input command and the feedback data in the PZD area at the TTA-PRO power up are described below.

Command	PZD1	PZD2	PZD3	PZD4	PZD5	PZD6
	Control Word	Sequence control	Not affected	Not affected	Target position	
Feedback	PZD1	PZD2	PZD3	PZD4	PZD5	PZD6
	Status Word	Sequence status	Actual current	Actual Velocity	Actual position	

The PNU 829 allows to modify the input command mapping from the PZD3 to the PZD6. The available input command signal to be mapped in the PZD command area are listed below:

Command signal	Size
Position set point (see PNU 767)	Double
Current limitation (see PNU 713)	Word
Speed set point (see PZD2 in speed mode)	Word
Current set point (see PZD2 in torque mode)	Word
Speed limitation (see PNU 714)	Word
Not affected	Word

- A 16 bit command signal (Word) is mapped on 1PZD
- A 32 bit command signal (Double) is mapped on 2 PZD

The PNU 828 allows to modify the feedback data mapping from the PZD3 to the PZD6. The available feedback signals to be mapped in the PZD feedback data area are listed below:

Feedback signal	Size
Motor current (see PNU 777)	Word
Motor speed (see PNU 776)	Word
Motor position (see PNU 774)	Double
Position error (see PNU 749)	Double
Drive error code	Word
DC bus voltage monitor	Word
Not affected	Word

- A 16 bit feedback signal (Word) is mapped on 1PZD
- A 32 bit feedback signal (Double) is mapped on 2 PZD

The modification of the PZD input command and feedback data signals are not saved in the drive EEPROM.

Chapter 3 - Parameter setting

1 – PARAMETER LIST

PNU	Parameter	Unit	Min.	Max.	Size	R/W	Saving	Default value
700	Number of motor pole pairs		1	32	word	R/W	E	4
701	Motor phases order				word	R/W	E	0xAAAA
702	Resolver / absolute encoder shift		0	65535	word	R/W	E	0
704	Auto-phasing procedure				-	W		
705	Stop current limit	%	327	32767	word	R/W		0x7FFF
710	Max. current	%	6553	32767	word	R/W	E	0x7FFF
711	Rated current	%	6553	16384	word	R/W	E	0x4000
712	I ^t protection mode				Boolean	R/W	E	1
713	Current limitation	%	0	32767	word	R/W		0x7FFF
714	Speed modulation	%	0	32767	word	R/W		
715	Current / Voltage rating				word	R		
716	Kp gain of D current loop		1	65535	word	R/W	E	0x100
717	Ki gain of D current loop		0	65535	word	R/W	E	0
718	Kp gain of Q current loop		1	65535	word	R/W	E	0x100
719	Ki gain of Q current loop		0	65535	word	R/W	E	0
720	Positioner mode				word	R/W		
721	Max. motor speed	rpm	100	25000	word	R/W	E	2500
722	Motor rotation direction				Boolean	R/W	E	0
723	Acceleration ramp	ms	0	16000	word	R/W	E	1
724	Speed following error threshold	rpm	1	25000	word	R/W	E	0x61A8
725	Motor thermal sensor configuration				Boolean	R/W	E	
726	Brake on delay	ms	0	16000	word	R/W	E	0
727	Brake off delay	ms	0	16000	word	R/W	E	0
728	Manual brake control				Boolean	R/W		
729	Saving in an EEPROM				-	W		
730	Proportional speed loop gain		0	65535	word	R/W	E	0x64
731	Integral speed loop gain		0	65535	word	R/W	E	0
732	Proportional position loop gain		0	65535	word	R/W	E	0
733	Feedforward Speed 1 Gain		0	65535	word	R/W	E	0
734	Current control filter		2832	61545	word	R/W	E	0x9C54
735	Anti-resonance filter		0	1	Boolean	R/W	E	0
736	Auto-tuning procedure		0	8	word	W		
737	Feedforward Acceleration gain		0	65535	word	R/W	E	0
738	Feedforward Speed 2 Gain		0	65535	word	R/W	E	0
739	Damping Speed Gain		0	65535	word	R/W	E	0
740	Position resolution	ppr	16	65534	word	R/W	E	0x1000
741	Following error threshold	pulse	1	32767	word	R/W	E	0x7FFF
742	Positioner configuration				word	R/W	E	0
743	User Output				word	R/W		0
744	Dead band				word	R/W	E	0
745	Position modulo				double	R/W	E	0
746	Counter position reset (CLEAR input)				double	R/W	E	0
747	Positive software position limit				double	R/W	E	0x7FFFFFFF
748	Negative software position limit				double	R/W	E	0x80000000
749	Position error	pulse			double	R		0
750	Encoder output resolution		512	16384	word	R/W	E	0x400
751	Number of marker pulses		1	16	word	R/W	E	1
752	Marker pulse shift		0	32767	word	R/W	E	0
753	Marker pulse width		0	32767	word	R/W	E	0x10
754	Encoder output programming				-	W		
756	Minimum duration SEQ output	ms	0	16383	word	R/W	E	0
757	“INPOS” window	pulse			double	R/W	E	0
758	CAM Position 1				double	R/W	E	
759	CAM Position 2				double	R/W	E	

760	Manual move speed	rpm	1	10000	word	R/W	E	0x64
761	Manual mode acceleration	ms	1	16000	word	R/W	E	0x320
762	Manual mode deceleration	ms	1	16000	word	R/W	E	0x320
763	Speed in jog	rpm	1	10000	word	R/W	E	0x1F4
764	Acceleration in jog	ms	1	16000	word	R/W	E	0x320
765	Deceleration in jog	ms	1	16000	word	R/W	E	0x320
766	Homing configuration				16 bits	R/W		0x0F0
767	Position input command	pulse	A	B	double	R/W		0
768	Offset Homing	pulse	A	B	double	R/W		0
769	Reading of the logic inputs				16 bits	R		
770	Positioner software version	-			double	R		
771	Profibus software version	-			word	R		
773	Positioner error	-			double	R		
774	Motor position	pulse			double	R		
775	Resolver value	pulse	0	65535	word	R		
776	Motor speed		-32767	+32767	integer	R		
777	Motor current		-32767	+32767	Integer	R		
778	Fault code				word	R		
780	Sequence reading				word	W		
781	Sequence writing				word	W		
782	Sequence control				16 bits	R/W	S	
783	Position in the sequence	pulse	A	B	double	R/W	S	
784	Speed in the sequence	rpm	0	10000	word	R/W	S	
785	Acceleration in the sequence	ms	1	16000	word	R/W	S	
786	Deceleration in the sequence	ms	0	16000	word	R/W	S	
787	Delay / running time	ms	0	16767	word	R/W	S	
788	Link (next sequence)		-1	127	word	R/W	S	
789	Counter		0	32767	word	R/W	S	
790	Counter link / conditional jump		-1	127	word	R/W	S	
791	Start condition				16 bits	R/W	S	
792	Programmable logic outputs				16 bits	R/W	S	
793	Triggering position	pulse	A	B	double	R/W	S	
794	Torque setpoint	%	0	32767	word	R/W	S	
795	Sequence control modification				16 bits	R/W		
796	Position modification	pulse	A	B	double	R/W		
797	Speed modification	rpm	0	10000	word	R/W		
798	Acceleration modification	ms	1	16000	word	R/W		
799	Deceleration modification	ms	1	16000	word	R/W		
800	Delay/running time modification	ms	1	16000	word	R/W		
801	Link (next sequence) modification		-1	127	word	R/W		
802	Counter modification		0	16000	word	R/W		
803	Counter link/conditional jump modification		-1	127	word	R/W		
804	Start condition modification				16 bits	R/W		
805	Programmable logic outputs modification				16 bits	R/W		
806	Triggering position modification	pulse	A	B	double			
807	Torque setpoint modification	%	0	32767	word	R/W		
810	Speed in the sequence	%	0	32767	word	R/W	S	
815	Speed modification	%	0	32767	word	R/W		
818	Amplifier analog input				word	R		0
819	Hardware logic inputs				word	R		0
820	Hardware inputs polarity				word	R/W	E	0
821	Hardware outputs polarity				word	R/W	E	0
822	Conditional inputs				word	R/W	E	0
823	Outputs pulses				word	R/W	E	0
824	Pulse duration	ms	1	16000	word	R/W	E	2000
828	PZD feedback mapping				word	R/W		
829	PZD command mapping				word	R/W		
830	Derivative speed loop gain		0	65535	word	R/W	E	0
831	Derivative speed loop gain filter	µs	0	10000	word	R/W	E	0
832	Speed loop gains scaling		1	1000	word	R/W	E	1

833	Speed measurement filter selection (Auto-tune): - Manual selection (0) - Auto select (1)		0	1	Boolean	R/W	E	1
834	Speed measurement filter		0	2	word	R/W	E	0
837	Controller requirement (Auto-tune): - Minimum following error (0) - No overshoot (1)		0	1	Boolean	R/W	E	0
838	Following error detection mode - Absolute (0) - Relative to dynamic model (1)		0	1	Boolean	R/W	E	0
839	Following error dynamic gain		0	65535	word	R/W	E	0
842	Drive configuration				word	R/W	E	0
843	Analog input command selection - Analog input command (0) - Profibus input command (1)		0	1	Boolean	R/W		1
845	Motor position	pulse	A	B	double	R		
846	2nd sensor position	pulse	A	B	double	R		
850	Absolute encoder resolution	ppr	0	2 ³¹	double	R	C	0
851	Absolute encoder revolutions	rev	0	65535	word	R	C	0
852	Absolute encoder position value	pulse			double	R		0
853	Absolute encoder position limit	pulse	0	2 ³¹	double	R		0
854	Absolute position reset				-	W		
855	Encoder position offset	pulse	0	2 ³² -1	double	R/W	E	0
856	Set user reference position				-	W		
857	User position offset	pulse	0	2 ³² -1	double	R/W	E	0
858	Position initialisation mode				word	R/W	E	0
859	Absolute position range setting				-	W		
860	Save homing				-	W		
865	SinCos input compensation				-	W		
870	Position resolution	ppr	16	65536	double	R/W	E	0x1000
873	Positioner warning code				word	R		
875	Cogging torque acquisition				-	W		
876	Cogging torque compensation		0	1	Boolean	R/W	E	0
879	Analog input filter		2832	61545	word	R/W	E	0x9C54
880	Analog input offset acquisition				-	W		
882	Motor temperature sensor : Error threshold		0	32767	word	R/W	E	0x7555
883	Motor temperature sensor : Warning threshold		0	32767	word	R/W	E	0x7555
884	Second sensor scaling denominator		1	65535	word	R/W	E	1
885	Second sensor configuration				word	R/W	E	0
886	Second sensor scaling numerator		1	65535	word	R/W	E	1
887	Enable encoder output (X3 connector)		0	1	Boolean	R/W		0
888	Encoder output division ratio		0	3	word	R/W	E	0
889	Encoder output deadband	pulse	0	4095	word	R/W	E	8
890	Encoder input type selection		0	15	word	R/W	E	0
891	Encoder input resolution	ppr	16	1000000	double	R/W	E	0x800
892	Enable encoder input interpolation		0	1	Boolean	R/W	E	0
893	Motor feedback sensor selection : - Resolver feedback (0) - Encoder feedback (1)		0	1	Boolean	R/W	E	0
894	Sensor feedback programming				-	W		
895	Hall Effect Sensor shift		0	65535	word	R/W	E	0
896	Motor phasing procedure				-	W		
897	Phasing OK output				word	R		
898	SinCos tracks motor feedback selection: - Resolver or encoder feedback (0) - SinCos tracks feedback (1)		0	1	Boolean	R/W	E	0

899	Specific function activation				word	R/W	0
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Notes R/W Reading/Writing
 A* Lower value limit in position = -32768 x (position resolution)
 B* Upper value limit in position = +32768 x (position resolution) - 1
 These limit values are theoretic values of the positioner.
 Saving:
 E These parameters are saved in the EEPROM by instruction 729.
 S These parameters are saved in the EEPROM by the instruction "Sequence writing" 781.

2 – PARAMETER DESCRIPTION

Motor parameters

Motor pole pairs **PNU :** **700**

This parameter is required for driving synchronous motors. It can be calculated by the auto-phasing procedure.

Parameter Number of motor pole pairs
Range 1-32
Execution With disabled positioner.

Motor phase order **PNU :** **701**

This parameter is required for driving synchronous motors. It can be calculated by the auto-phasing procedure.

Parameter Motor phase order: corresponds to the phase order (U, V, W) of the motor connection.
Conversion 2 possible values 0x5555 (120°) or 0xAAAA (240°)
Execution With disabled positioner.

Position sensor offset **PNU :** **702**

This parameter is required for driving synchronous motors. It can be calculated by the auto-phasing procedure.

Parameter phase shift between position sensor and motor rotor.
Conversion Resolver feedback :
 5.4931640625e-3*(number of pole pairs). The value obtained is the shift in electrical degrees.
 Absolute encoder feedback :

Bit number	Description
0-14	Absolute value of the offset 0 to 7FFFh (0 to 360° electrical degree).
15	Sign of the offset (encoder wiring direct or reverse)

Execution With disabled positioner.

Auto-phasing **PNU :** **704**

Parameter None.
Limitation Writing only.
Note This procedure allows the automatic calculation of the motor parameters:
 - number of motor pole pairs,
 - motor phase order,
 - resolver / absolute encoder offset.



The motor must first be disabled and **uncoupled from the mechanical load**. The ENABLE signal (X4 connector) must also be active. Before executing the procedure, check for free motor shaft rotation over one revolution, that is not dangerous for the operator.
 When the motor parameters are known, it is not necessary to execute the auto-phasing.

Current parameters

Stop current limit PNU : 705

Defines the current limitation value when the motor is slowed down on ENABLE input desactivation or on fault reaction. This parameter value is given with regard to the maximum current parameter value (% of I_{max}).

Parameter 1 word.
Limitation 327(1% of I_{max}) to 32767 (100% of I_{max})

Maximum current PNU : 710

Defines the max. current limitation in the motor (I_{max}).

Parameter 1 word.
Conversion in percentage of the positioner current rating: x 3.051850948e-3.
Limitation 6554 (20%) to 32767 (100%)
Execution
Note This parameter is defined according to the positioner and motor specifications.

Rated current PNU : 711

Defines the rated current limitation in the motor.

Parameter 1 word.
Conversion in percentage of the current rating: x 3.051850948e-3.
Limitation 6554 (20 %) to 16384 (50%)
Execution
Note This parameter is defined according to the positioner and motor specifications.

I²t mode PNU : 712

Parameter 1 word.
 0 limiting mode.
 1 fusing mode.
Note See SERVOPAC TTA-PRO User manual for the I²t protection mode description.

Current limitation PNU : 713

Defines the current limitation in the motor with regard to the value defined by the maximum current.

Parameter 1 word.
Limitation 0 to 32767 (100% of I_{max})

Speed modulation

Speed modulation PNU : 714

This parameter allows a speed modulation. The value corresponds to a percentage of the programmed speed. In positioning sequences, the percentage of the programmed speed can be modified on-the-fly during the sequence execution. In homing and speed sequences, the percentage of the programmed speed will actually be applied when starting the sequence and any modification of this percentage will have no effect until the motion is over. Speed modulation is also operating in manual movements.

Parameter 1 word.
Unit %
Limitation 0 to 32767 (100%)

Current loops

Current/Voltage rating identification PNU : 715

Gives the positioner current rating and voltage.

Parameter bit 4 : 0 230 V positioner
1 400 V positioner

Bits 3, 2, 1, 0	Rating (Arms) in 230 V	Rating (Arms) in 400 V
1	2.25	1.8
2	4.5	2.7
3	7.5	5.1
4	10.5	7.2
5	16.5	14
6	27	30
7		45
8	45	60
9	60	90
10	90	20
11	120	

The TTA-PRO positioner has 2 digital PI regulators for the D-Q current loops. The gains are the following:

Proportional gain for D current loop PNU : 716

Integral gain for D current loop PNU : 717

Proportional gain for Q current loop PNU : 718

Integral gain for Q current loop PNU : 719

Positioner parameters

Positioner mode PNU : 720

Defines the positioner operation mode (position, speed or torque).

Parameter 1 word

- 1 torque mode
- 2 speed mode with PI regulator
- 4 positioner mode
- 8 speed mode with P regulator
- 16 speed mode with PI² regulator

Execution This instruction must be executed with disabled positioner.
In standard, the positioner is always configured in position mode at power on
(see PNU 842 bit 9 for enabling the torque or speed mode saving in the drive EEPROM).

Max. speed PNU : 721

Defines the maximum application speed (and the speed scale as well). The speed set point value for the sequences and for the manual movements (positioning and jog) is saved in % with regard to this parameter value. So when this parameter value is changed, all speed set point values are scaled accordingly.

Parameter 1 word.

Limitation This parameter varies between 100 rpm and 25000 rpm.

Execution With disabled positioner.

Motor rotation direction PNU : 722

This instruction allows to reverse the motor rotation direction with regard to the input command. It also reverses the position feedback.

Parameter 1 word :

- = 0: normal.
- = 1: reversed.

Execution With disabled positioner.

Acceleration ramp PNU : 723

Defines the motor acceleration or deceleration time that corresponds to the maximum speed.

Parameter 1 word.
Conversion in second: x 0.0005
Limitation 1 (without acceleration ramp) at 65535 (#30 s).
Note This parameter can only be used in speed mode.

Speed following error threshold PNU : 724

When the speed error is higher than this value, the following error is released

Parameter 1 word.
Unit rpm
Limitation 1 to 25000.

Motor thermal sensor type

Motor thermal sensor PNU : 725

Defines the motor thermal sensor type used.

Parameter Boolean.
 0 NTC sensor
 1 PTC sensor

Brake control

Brake on delay PNU : 726

Defines the time between the brake release and the positioner disabling.

Parameter 1 word
Unit ms
Limitation 0-16000

Brake off delay PNU : 727

Defines the time between the positioner enabling and the brake inhibition.

Parameter 1 word
Unit ms
Limitation 0-16000

Manual brake control PNU : 728

This instruction enables or inhibits the brake.

Parameter 1 word.
 0 inhibits the brake relay output (relay closed).
 1 releases the brake relay output (relay open).
Limitation Writing only.

Parameter saving

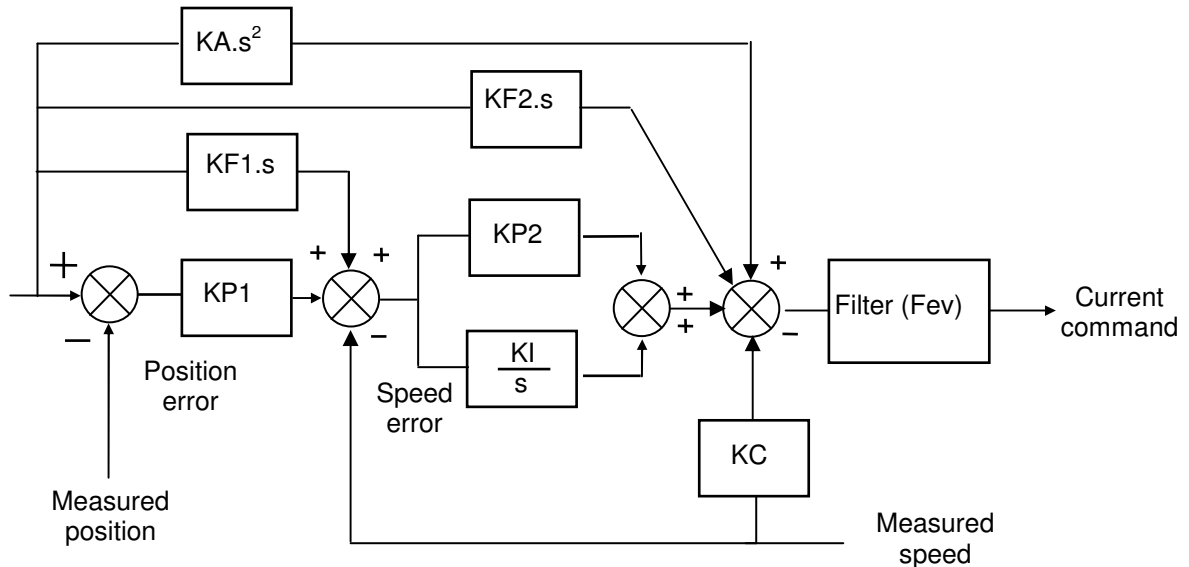
Saving in the EEPROM PNU : 729

Saves all positioner parameters in the EEPROM (see parameters list in the section 1 of this chapter).

Parameter none.
Limitation Writing only.
Execution With positioner disabled.

Regulator gains

The structure of the regulator used for the TTA-PRO is shown below :



All gain parameters (KF1, KF2, KP1, KP2, KI, KA, KC and Fev) are automatically calculated during the auto-tuning procedure.

Proportional speed loop gain

PNU :

730

Defines the proportional regulator gain (KP2) that acts upon the speed error.

Parameter 1 word.

Conversion 1/16

Limitation 0 to 65535

Integral speed loop gain

PNU :

731

Defines the integral regulator gain (KI) that acts upon the speed error.

Parameter 1 word.

Conversion 1/256

Limitation 0 to 65535

Proportional position loop gain

PNU :

732

Defines the proportional gain that acts upon the position error (KP1).

Parameter 1 word.

Conversion 1/65536

Limitation 0 to 65535

Feedforward speed 1

PNU :

733

Defines the feedforward speed amplitude (KF1) corresponding to the speed input command (derivation of the position input command). This feedforward term allows to reduce the following error during the motor acceleration and deceleration phases.

Parameter 1 word.

Conversion 1/65536

Limitation 0 to 65535

Current control low-pass filter

PNU :

734

Defines the cut-off frequency at -3 dB (Fev) of the first order filter that acts upon the current control. The value of this parameter is depending on the selected bandwidth.

Parameter 1 word.

Conversion $\text{Frequency (Hz)} = 1000/\pi * \ln(65536/\text{parameter})$

Limitation This parameter can take a value between 2832 (1000 Hz) and 61545 (20 Hz).

Antiresonance filter **PNU :** 735

Releases or inhibits the antiresonance filter.

Parameter 1 word.
 = 0: inhibits the filter,
 = 1: releases the filter.

Auto-tuning **PNU :** 736

This procedure identifies the specific motor and load parameters and calculates the regulator gain parameters.

Parameter 1 word.
 0 low bandwidth.
 1 medium bandwidth.
 2 high bandwidth.
 3 low bandwidth with antiresonance filter.
 4 medium bandwidth with antiresonance filter.
 5 high bandwidth with antiresonance filter.
 6 low bandwidth with high stiffness filter.
 7 medium bandwidth with high stiffness filter.
 8 high bandwidth with high stiffness filter.

Limitation Writing only.

Execution With disabled positioner and ENABLE signal activated, or enabled positioner and motor at standstill (zero speed).

Note When executing this procedure, the speed loop bandwidth can be selected (low, medium or high). These values correspond to the cut-off frequency for a 45° speed loop phase shift.



The reading indicates the previously selected bandwidth (0, 1, 2, 3, 4 or 5).

Before executing this instruction, check for free motor shaft rotation over one revolution, that is not dangerous for the operator.

The auto-tuning procedure is not required when the regulator parameters are known.

Feedforward acceleration gain **PNU :** 737

Defines the feedforward acceleration amplitude (KA) corresponding to the acceleration input command (second derivation of the position input command). This feedforward term allows to reduce the following error during the motor acceleration and deceleration phases.

Parameter word.
Conversion 1/65536
Limitation 0 to 65535

Feedforward Speed 2 gain **PNU :** 738

This gain value (KF2) is equal to the damping speed gain value + Feedforward friction gain value. The feedforward friction gain allows to cancel the load viscous friction effect (load viscous friction torque is proportional to axis speed). This feedforward term allows to reduce the following error during the motor acceleration and deceleration phases.

Parameter word.
Conversion 1/16
Limitation 0 to 65535

Speed loop damping gain **PNU :** 739

This gain is used for getting the maximum servo loop stiffness.

Parameter word.
Conversion 1/16
Limitation 0 to 65535

Application parameters

Position resolution **PNU :** 740

This parameter defines the number of position increments for one motor revolution (or one motor pole pitch for a linear motor).

Parameter 1 word.
Limitation 0, corresponding to a resolution of 65536 (full scale), or from 128 to 65534 (always an even number).

Execution With disabled positioner.

Note This position resolution consequently defines the format of both position input command and position feedback.

Position following error threshold **PNU :** **741**

When the position error is higher than this value, the following error is released

Parameter 1 word.

Conversion See position resolution.

Positioner configuration **PNU :** **742**

<i>Parameter</i>	bit	description
	0	Positive limit switch (software FC+)
	1	Negative limit switch (software FC-)
	3	0 = Constant time profile limit 1 = Constant slope profile limit
	4	CLEAR input active
	5	Forward only (Position Modulo)
	8	Activation of the speed limitation
	9	Activation of the speed modulation
	12	Minimum Sequence Pulse
	13	"Inpos" windows
	14	CAM function
	15	0 = trapezoidal profile 1 = S-curve profile

User output **PNU :** **743**

Defines the outputs of bits 8 to 15 of HIW.

Parameter byte

Deadband **PNU :** **744**

Defines the deadband for the position controller. When this parameter is set at 0, the deadband is disabled.

Parameter word

Position modulo **PNU :** **745**

Defines the position after which the position counter is reset at 0. This function allows to get a motor position modulo (only useful for rotary axes).

Parameter double word

Counter position reset (CLEAR input) **PNU :** **746**

This function is released by [PNU 742](#) and allows to reset the position counter at this value when the CLEAR input is activated (this value is generally 0). This function is useful for rotary axes.

Parameter double word

Positive software limit switch **PNU :** **747**

Defines the value of the positive software limit switch which release is defined by [PNU 742](#).

Parameter double word

Negative software limit switch **PNU :** **748**

Defines the value of the negative software limit switch which release is defined by [PNU 742](#).

Parameter double word

Position error value **PNU :** **749**

Display the position loop error value.

Parameter double word.

Conversion See position resolution.

Encoder Output resolution

Encoder output resolution PNU : 750

Defines the encoder output resolution.

Parameter 1 word: encoder resolution

Limitation The encoder resolution is limited by the maximum application speed.

Maximum motor speed (rpm)	up to 1600	up to 3200	up to 6400	up to 12800	up to 25000
Encoder output resolution (ppr)	512 to 16384	512 to 8192	512 to 4096	512 to 2048	512 to 1024

This resolution value can be divided by 2, 4 or 8 by using the [PNU 888](#).

Execution With disabled positioner.

Note The encoder output only takes into account this parameter after the end of the procedure "encoder output programming".

Encoder input Zero Mark pitch

Encoder input Zero Mark pitch PNU : 751

This parameter is equal to the number of encoder pulses between two successive Zero Mark signals divided by the Encoder Input Resolution value (see [PNU 891](#)). For a rotary motor, this parameter is generally equal to 1 because the encoder has got one Zero Mark signal per motor revolution. For a linear motor, this parameter is equal to the number of motor pole pairs between two successive Zero Mark signal. This parameter is used for the encoder counting protection when the encoder input is selected for the motor feedback.

Parameter 1 word

Conversion See table below.

Value	Description
0	No encoder counting protection
1 to 14	Encoder counting protection active: checks the number of encoder pulses between two successive Zero Mark signals. Used for rotary or linear motors.
15	Encoder counting protection active: controls the encoder position value for the Zero Mark signal activation. Used for applications with only one Zero Mark signal over the motor travel (linear motor)

Encoder output Marker Pulse

Encoder output marker pulse phase shift PNU : 752

This parameter allows the shifting of the marker pulse position on channel Z with regard to the zero position of the feedback position sensor.

Parameter word

Conversion Marker pulse phase shift : the value 32767 corresponds to one revolution of the motor shaft.

Note The positioner, takes into account, the phase shift value with regard to the zero position of the feedback position sensor during the homing procedure.

Encoder output marker pulse width PNU : 753

This parameter is not used in the ServoPac-A amplifier range.
The marker pulse width is equal to $\frac{1}{4}$ of the A and B channels period.

Encoder output programming

Encoder output programming PNU : 754

This procedure programs the encoder output according to the new encoder output parameter values ([PNU 750](#) and [PNU 888](#)).

Limitation Writing only.

Execution With disabled positioner.

Note The execution of this procedure takes approximately 5 s.

Specifics outputs parameters

Minimum duration SEQ output PNU : 756

Allows to define the minimum duration of the SEQ output. This function is released by [PNU 742](#).

Parameter word

Limitation 0 - 16000 ms

0 means no minimum duration for the SEQ output.

"INPOS" window PNU : 757

Defines a position window in which the POS output is activated. This possibility is released by [PNU 742](#).

Parameter double word

CAM position 1 and 2 PNU : 758, 759

Defines the positions between which the OUT1 output (bit 8 of HIW) is activated. This possibility is released by [PNU 742](#).

Parameter double word

Manual motion parameters

Manual motion speed PNU : 760

Parameter Speed in rpm.

Limitation 1 - 25000 according to the value of the "Max. speed" parameter.

Note When the "Max. Speed" parameter value (PNU 721) is changed, this parameter value is scaled accordingly.

Acceleration ramp in manual motion PNU : 761

Parameter This parameter, defined in ms, corresponds to the acceleration time at max. speed.

Limitation 1 - 16000

Note The minimum value depends on the motor and on the system inertia.

Deceleration ramp in manual motion PNU : 762

Parameter This parameter, defined in ms, corresponds to the deceleration time between max. speed and standstill.

Limitation 1 - 16000

Note The minimum value depends on the motor and on the system inertia.

Speed in jog PNU : 763

Parameter Speed in rpm.

Limitation 1 - 25000 according to the value of the "Max. speed" parameter.

Note When the "Max. Speed" parameter value (PNU 721) is changed, this parameter value is scaled accordingly.

Acceleration ramp in jog PNU : 764

Parameter This parameter, defined in ms, corresponds to the acceleration time from standstill up to max. speed.

Limitation 1 - 16000

Note The minimum value depends on the motor and on the system inertia.

Deceleration ramp in jog PNU : 765

Parameter This parameter, defined in ms, corresponds to the deceleration time from max. speed down to standstill.

Limitation 1 - 16000

Note This parameter is also used for emergency stops with programmed braking.

Homing configuration PNU : 766

This parameter defines the configuration of a manual homing.

<i>Parameter</i>	bit	description
	3	Dir
	4	Switch
	5	Zero
	6	Origin
	7	Reset

Note The motion speed and the acceleration and deceleration ramps are those of the manual motion.

Position input command **PNU :** **767**

This parameter defines the position input command for a manual motion in absolute mode (bit 12 of the Control Word) or in relative mode (bit 13 of the Control Word).

Parameter 32 bits

Note This parameter defines the position input command if the PPO message used does not contain itself this position input command. Consequently, if a PPO message containing the position input command is used, this input command will replace the value of the input command contained in the [PNU 767](#).

Homing offset **PNU :** **768**

This parameter defines the value that must be taken by the position counter at the end of a manual homing procedure (bit 11 of the Control Word).

Parameter double word

Command logic inputs

Reading of the logic inputs **PNU :** **769**

This parameter allows the reading of the logic inputs.

Bits	Meaning
0	Software limit switch +
1	Software limit switch -
4	Hardware limit switch +
5	Hardware limit switch -
6	Index
8	ENABLE

Software version

Positioner software version **PNU :** **770**

Reading of the positioner software version.

Parameter 32 bits in hexadecimal.

Example Version 506.78 is coded as 0x00050678

Profibus software version **PNU :** **771**

Software version reading of the positioner's Profibus interface.

Parameter 16 bits in hexadecimal.

Example Version 3.01 is coded as 0x0301

Positioner error code

Positioner error code **PNU :** **773**

Reading of the positioner error code.

Parameter 3 bytes

Byte 1 (low weight):

Bits	Meaning	Descriptions
0		
1	I ² t	I ² t
2	RDC / COUNT	Resolver converter error / Encoder counting error
3	POS	Position following error
4	MEM	Parameters / Sequences / Cogging memory error
5	BUS	Profibus DP mode error
6		
7	BUSY	Procedure error

Byte 2:

Bits	Meaning	Descriptions
0	2nd SENSOR	2nd position sensor cable interruption error
1	POWER	Power stage error
2	RES / COD / HES	Resolver / Encoder / Hall sensor cable interruption error
3	AP	Power undervoltage error
4	24 V	24 V error
5	TMOT	Motor temperature error
6	CDG	Watchdog error
7		

Byte 3 (high weight):

Bits	Meaning	Descriptions
0	HOME	Homing procedure timeout error
1	E2PPAR	Parameters EEPROM checksum error
2	E2PSEQ	Sequences EEPROM checksum error
3	E2PCOG	Cogging torque memory checksum error
4	SEQWR	Sequence writing error
5		
6		
7		

Monitoring signals

Motor position PNU : 774

Reading of the motor position.
Parameter 32 bits

Resolver value PNU : 775

Reading of the value provided by the resolver. This value is an absolute position over one revolution.
Parameter 16 bits

Speed monitor PNU : 776

Motor speed monitor.
Parameter integer.
0x7FFF corresponds to the maximum motor speed.

Current monitor PNU : 777

Motor current monitor.
Parameter integer.
0x7FFF corresponds to the maximum current (= rating) in the motor.

Power stage faults

Fault code PNU : 778

Parameter word.

Bit 0-2:	2	Power voltage error
	3	Out of 24 Vdc range (18 V to 29 V)
	4	Motor phases/earth short-circuit.
	5	Braking system error
	6	Fan error
	7	Motor holding brake error
Bit 3:		IGBT module error
Bit 4:		Power undervoltage. This error has no influence on the AOK signal
Bit 9:		400 V power stage initialization error
Bit 10:		Power configuration error
Bit 11:		Current measurement offset error
Bit 15:		Current error

Sequence Reading / Writing

A sequence is defined by a list of parameters (PNU 782 to PNU 794):

- Sequence control
- Position
- Speed
- Torque
- Gearing ratio
- Acceleration
- Deceleration
- Delay time
- Link
- Counter
- Counter link
- Condition
- Logic outputs
- Output position

CAUTION !

When the parameter " position resolution " is modified, all position values in the sequences are also modified. When the parameter "Max. motor speed" is modified, all speed parameters in the sequences are modified as well. Consequently, when the sequence parameters are sent to the positioner, it must be previously programmed with the correct "position resolution" and "max. motor speed" parameters.

All sequences are saved in the EEPROM. The direct access to a sequence in the EEPROM is not possible. The transfer requires a buffer: the command PNU 780 allows to transfer the EEPROM parameters to the buffer and the command PNU 781 allows to transfer the buffer parameters to the EEPROM. The writing or reading of the buffer parameters are made by commands PNU 782 to PNU 794.

Reading of a sequence PNU : 780

<i>Parameter</i>	0-127	sequence number
<i>Note</i>	This instruction transfers the sequence parameters from the EEPROM to the buffer. This allows the parameter values to be read in the buffer (see PNU 781).	

Writing of a sequence PNU : 781

<i>Parameter</i>	0-127	sequence number
	128	checksum
<i>Note</i>	This instruction transfers the sequence parameters from the buffer to the EEPROM. The sequence parameters must of course be previously written in the buffer (see PNU 780). When all sequences are written, a sequence must be written with a value of 128; this allows to update the checksum in the EEPROM (otherwise, the positioner will indicate an EEPROM fault at its next powering). The writing in the EEPROM is not instantaneous; wait at first for the positioner reply before writing other parameters.	

All instructions below allow the access to the parameters of the sequence contained in the buffer.

Sequence control PNU : 782

<i>Parameter</i>	bit	description
	0	1 = valid sequence 0 = non valid sequence
	1	0 = positioning 1 = homing
	2	0 = absolute positioning 1 = relative positioning
	3	1 = speed sequence / gearing sequence
	4	reserved
	5	1 = torque sequence
	6	reserved
	7	1 = gearing sequence

If the sequence is a homing (bit 1 = 1), bits 3 to 7 have following meanings:

3	0 = positive direction 1 = negative direction
4	0 = without switch 1 = with switch
5	0 = without marker pulse 1 = with marker pulse
6	0 = stops the motor after the home position found 1 = positions the motor on the home position
7	0 = does not reset the position counter 1 = resets the position counter
8 -11	define the triggering for the logic inputs:
	0 End
	1 Begin
	2 Stop
	3 Speed
	4 Pos
12-14	reserved.
15	= 0 conditional start = 1 conditional stop

Note To invalidate a sequence, just send this instruction with the value 0; the other parameters will be ignored.

Position in the sequence **PNU :** **783**

This parameter defines the position for a positioning sequence (absolute or relative), or the Reset value for a homing sequence, or the gearing distance for a gearing sequence.

<i>Parameter</i>	double word
<i>Unit</i>	user units (depends on the position resolution)
<i>Variation</i>	(-32768 x resolution) to (32768 x resolution - 1)

Speed in the sequence **PNU :** **784**

Defines the motion speed.

<i>Parameter</i>	word
<i>Unit</i>	rpm
<i>Variation</i>	1 at max. speed for a positioning; can be negative if the sequence is a speed sequence.
<i>Note</i>	When the "Max. Speed" parameter value (PNU 721) is changed, this parameter value is scaled accordingly.

Acceleration in the sequence **PNU :** **785**

This parameter defines the positioning acceleration ramp. For speed and torque sequences, it defines the real acceleration time.

<i>Parameter</i>	word
<i>Unit</i>	ms
<i>Variation</i>	1 to 16000
<i>Note</i>	The real minimum value depends on the motor and the inertia.

Deceleration in the sequence **PNU :** **786**

This parameter defines the positioning deceleration ramp. For speed sequences, it defines the actual deceleration time.

<i>Parameter</i>	word
<i>Unit</i>	ms
<i>Variation</i>	0 to 16000
<i>Note</i>	The real minimum value depends on the motor and the inertia. The value 0 allows to link up to another sequence (parameter Link) without stopping.

Delay / running time **PNU :** **787**

This parameter defines either:

- a delay time at the end of the positioning, for a positioning sequence or,
- a motion time at constant speed for a speed sequence or,
- the time out for a homing sequence.

<i>Parameter</i>	word
<i>Unit</i>	ms for the positioning and speed sequences s for the homing sequences
<i>Variation</i>	0 to 16000

Link (next sequence) PNU : 788

<i>Parameter</i>	0-127	number of the link sequence
	-1	no link

Counter PNU : 789

<i>Parameter</i>	word
<i>Variation</i>	1 - 32767
	0 no counter
	-1 conditional link

Counter link/conditional jump PNU : 790

<i>Parameter</i>	0-127	number of the link sequence
	-1	no link
<i>Note</i>	For a conditional jump, the counter value must be 0	

Start (or stop) condition PNU : 791

This parameter defines the condition on the inputs status for the start (or stop) of the sequence. The effect of this condition on the sequence operation (starts or stops the sequence) is defined by bit 15 of the sequence control parameter (PNU 782).

<i>Parameter</i>	word
	bit description
	0-7 Defines the inputs (IN1 to IN8) which must be set at 0 for the start (or stop) condition
	8-15 Defines the inputs (IN1 to IN8) which must be set at 1 for the start (or stop) condition
<i>Example</i>	Conditions: bits 1 and 3 = 1 bit 6 = 0
	The value will be 0x0A40

Programmable logic outputs PNU : 792

This parameter defines the effect on the logic outputs in this sequence.

<i>Parameter</i>	word
	bit description
	0-7 mask s for the outputs 0 to 7.
	8-15 mask r for the outputs 0 to 7.
	The combination of the s and r masks gives:
	rs
	01 -> sets at 1 the corresponding output.
	00 -> sets at 0 the corresponding output.
	10 -> keeps the output unchanged.
	11 -> reverses the output.

Example If no output is modified, the value is 0xFF00

Triggering position PNU : 793

Defines the position that triggers the inputs when the motor passes this position.

<i>Parameter</i>	double
<i>Note</i>	This parameter is only effective when the inputs triggering type is a position.

Torque setpoint / Gearing ratio PNU : 794

This parameter defines the torque value as a percentage of the maximum current value for a torque sequence. This parameter absolute value defines the gearing ratio factor as a percentage of the master/slave gearing ratio value for a gearing sequence. This parameter negative sign, allows to reverse the motor displacement direction , with regard to the second sensor displacement for a gearing sequence.

<i>Parameter</i>	word
<i>Conversion</i>	Torque sequence: 0 to 32767 (100% of I _{max})
	Gearing sequence:
	bit description
	0 to 14 Gearing ratio factor : 327 (1%) to 32767 (100%)
	15 Enable/Disable reverse gearing

Sequence control modification in the sequence **PNU :** **795**

This parameter directly modifies the sequence control in the RAM. The sequence must be valid. This modification takes effect immediately.

Parameter 16 bits

Index Byte 3 of PKW = number of the sequence to be modified.

Note This value is not stored in the EEPROM and will consequently be lost at power off. At the next power on, look for the sequence control at the value stored before, by means of the [PNU 781](#) command.
But a sequence control must not be modified during the sequence running.

Position modification in the sequence **PNU :** **796**

This parameter directly modifies the position parameter of a sequence in the RAM; the sequence must be valid. This modification takes effect immediately.

Parameter double word

Index Byte 3 of PKW = number of the sequence to be modified.

Unit depends on the position resolution.

Variation (-32768 x resolution) to (32768 x resolution - 1)

Note This position value is not stored in the EEPROM; consequently, it will be lost at power off. At the next power on, look for the position at the value saved before, by means of command [PNU 781](#).

But a sequence position must not be modified during a sequence execution.

Speed modification in the sequence **PNU :** **797**

This parameter directly modifies the speed parameter of a sequence in the RAM; the sequence must be valid. This modification takes effect immediately.

Parameter word

Index Byte 3 of PKW = number of the sequence to be modified.

Unit rpm

Variation 1 to max. speed for a positioning; can be negative if the sequence is a speed sequence.

Notes When the "Max. Speed" parameter value (PNU 721) is changed, this parameter value is scaled accordingly.

This speed value is not stored in the EEPROM. Consequently, it will be lost at power off. At the next power up, find the former saved speed value by command [PNU 781](#).

But a sequence speed must not be modified during the execution.

Acceleration modification in the sequence **PNU :** **798**

This parameter directly modifies the acceleration for a sequence in the RAM. The sequence must be valid. This modification takes effect immediately.

Parameter Word

Index Byte 3 of PKW = number of the sequence to be modified.

Unit ms

Variation 1 to 16000.

Notes This acceleration value is not stored in the EEPROM. Consequently, it will be lost at power off. At the next power on, look for the acceleration at the value stored before, by means of the [PNU 781](#) command.

But a sequence acceleration must not be modified during the sequence running.

Deceleration modification in the sequence **PNU :** **799**

This parameter directly modifies the deceleration for a sequence in the RAM. The sequence must be valid. This modification takes effect immediately.

Parameter Word

Index Byte 3 of PKW = number of the sequence to be modified.

Unit ms

Variation 1 to 16000.

Notes This deceleration value is not stored in the EEPROM. Consequently, it will be lost at power off. At the next power on, look for the deceleration at the value stored before, by means of the [PNU 781](#) command.

But a sequence deceleration must not be modified during the sequence running.

Delay / running time modification in the sequence **PNU :** **800**

This parameter directly modifies the delay time for a sequence in the RAM. The sequence must be valid. This modification takes effect immediately.

Parameter Word

Index Byte 3 of PKW = number of the sequence to be modified.

Unit ms

Variation 1 to 16000.

Notes This delay time value is not stored in the EEPROM. Consequently, it will be lost at power off. At the next power on, look for the delay time at the value stored before, by means of the [PNU 781](#) command.
But a sequence delay time must not be modified during the sequence running.

Link (Next sequence) modification in the sequence **PNU :** **801**

This parameter directly modifies the link in a sequence in the RAM. The sequence must be valid. This modification takes effect immediately.

Parameter Word

Index Byte 3 of PKW = number of the sequence to be modified.

Unit

Variation -1 to 127.

Notes This value is not stored in the EEPROM. Consequently, it will be lost at power off. At the next power on, look for the link parameter at the value stored before, by means of the [PNU 781](#) command.

But the link parameter must not be modified during the sequence running.

Counter modification in the sequence **PNU :** **802**

This parameter directly modifies the counter value in a sequence in the RAM. The sequence must be valid. This modification takes effect immediately.

Parameter Word

Index Byte 3 of PKW = number of the sequence to be modified.

Unit

Variation 0 to 16000.

Notes This counter value is not stored in the EEPROM. Consequently, it will be lost at power off. At the next power on, look for the counter parameter at the value stored before, by means of the [PNU 781](#) command.

But the counter parameter must not be modified during the sequence running

Counter link/conditional jump modification in the sequence **PNU :** **803**

This parameter directly modifies the counter link in a sequence in the RAM. The sequence must be valid. This modification takes effect immediately.

Parameter Word

Index Byte 3 of PKW = number of the sequence to be modified.

Unit

Variation -1 to 127.

Notes This value is not stored in the EEPROM. Consequently, it will be lost at power off. At the next power on, look for the counter link parameter at the value stored before, by means of the [PNU 781](#) command.

But the counter link parameter must not be modified during the sequence running.

Start condition modification in the sequence **PNU :** **804**

This parameter directly modifies the start condition in a sequence in the RAM. The sequence must be valid. This modification takes effect immediately.

Parameter 16 bits

Index Byte 3 of PKW = number of the sequence to be modified.

Unit

Variation

Notes This value is not stored in the EEPROM. Consequently, it will be lost at power off. At the next power on, look for the start condition at the value stored before, by means of the [PNU 781](#) command.

But the start condition parameter must not be modified during the sequence running.

Programmable logic outputs modification in the sequence **PNU :** **805**

This parameter directly modifies the logic outputs in a sequence in the RAM. The sequence must be valid. This modification takes effect immediately.

Parameter 16 bits

Index Byte 3 of PKW = number of the sequence to be modified.

Unit

Variation

Notes This value is not stored in the EEPROM. Consequently, it will be lost at power off. At the next power on, look for the logic outputs configuration at the value stored before, by means of the [PNU 781](#) command.

But the logic outputs configuration must not be modified during the sequence running.

Triggering position modification in the sequence **PNU :** **806**

This parameter directly modifies the triggering position in a sequence in the RAM. The sequence must be valid. This modification takes effect immediately.

Parameter double word
Index Byte 3 of PKW = number of the sequence to be modified.
Unit pt

Variation

Notes This triggering position is not stored in the EEPROM. Consequently, it will be lost at power off. At the next power on, look for the triggering position at the value stored before, by means of the [PNU 781](#) command. But the triggering position must not be modified during the sequence running.

Torque setpoint modification in the sequence **PNU :** **807**

This parameter directly modifies the torque setpoint / gearing ratio factor in a sequence in the RAM. The sequence must be valid. This modification takes effect immediately.

Parameter Word
Index Byte 3 of PKW = number of the sequence to be modified.
Unit %

Variation

Notes This torque setpoint is not stored in the EEPROM. Consequently, it will be lost at power off. At the next power on, look for the torque setpoint at the value stored before, by means of the [PNU 781](#) command. But the torque setpoint must not be modified during the sequence running.

Speed in the sequence **PNU :** **810**

Defines the motion speed.

Parameter word
Unit % of max speed
Conversion 32767 for max speed
Variation 1 to 32767, can be negative if the sequence is a speed sequence.
Note same parameter than [PNU 784](#).

Speed modification in the sequence **PNU :** **815**

This parameter directly modifies the speed parameter of a sequence in the RAM; the sequence must be valid. This modification takes effect immediately.

Parameter word
Index Byte 3 of PKW = number of the sequence to be modified.
Unit % of max speed
Conversion 32767 for max speed
Variation 1 to 32767, can be negative if the sequence is a speed sequence.
Notes same parameter than [PNU 797](#).

Analog input

Analog input voltage **PNU :** **818**

Reading of the value on the analog input.

Parameter word
Conversion +/- 7FFF corresponds to +/- 10V
Remark The analog input must be selected by the 3 jumpers located on the amplifier connector board.

Logic inputs / Logic outputs

Hardware logic inputs **PNU :** **819**

Reading of the value on the logic input on the X2 connector.

Parameter word
Conversion bit 7 to 0 = IN6-IN1, STOP, START

Inputs polarity **PNU :** **820**

This parameter defines the polarity of the optocoupled logic inputs : active by 24 V / active by 0 V.

Parameter word
Conversion bit 0 = Start
bit 1 = Stop
bit 8 to 15 = IN1 to IN8
0 = actived by 24 V, 1 = actived by 0 V

Outputs polarity PNU : 821

This parameter defines the polarity of the logic outputs : active=24 V / active=0 V.

Parameter word
Conversion bit 0 = Seq
 bit 1 = Pos
 bit 2 = Speed
 bit 8 to 15 = OUT1 to OUT8
 0 = 24 V when active, 1 = 0 V when active

Conditional inputs PNU : 822

This parameter defines the inputs configuration : used for the start condition / used for selecting sequences.

Parameter word
Conversion bit 0 to 7 = IN1 to IN8
 1 = start condition, 0 = sequence control

Output pulse PNU : 823

The outputs OUT1 to OUT8 can be defined as pulse outputs which duration is defined by [PNU 824](#).

Parameter word
Conversion bit 0 to 7 = OUT1 to OUT8
 1 = pulse output, 0 = standard output

Pulse duration PNU : 824

Defines the time duration for the logic outputs defined as pulse outputs by [PNU 823](#).

Parameter 1 word
Unit ms
Limitation 0-16000

Mapping of the PZD data

PZD feedback mapping PNU : 828

Modification of the PZD feedback mapping from PZD3 to PZD6.

Index Byte 3 of PKW = Index of the feedback signal mapping (index 0 corresponds to the first mappable PZD i.e. PZD3).

Parameter Selection of the feedback signal to be mapped according to the following values:

Parameter	Feedback signal	Size
0x1309	Motor current (see PNU 777)	Word
0x1308	Motor speed (see PNU 776)	Word
0x2306	Motor position (see PNU 774)	Double
0x22ED	Position error (see PNU 749)	Double
0x12F3	Drive error code (see note 1 below)	Word
0x12C2	DC bus voltage monitor (see note 2 below)	Word
0x1348	Not affected	Word

A 16 bit feedback signal (Word) is mapped on 1PZD

A 32 bit feedback signal (Double) is mapped on 2 PZD

Default value

Index	Parameter	PZD number	Feedback signal
0	0x1309	PZD3	Motor current
1	0x1308	PZD4	Motor speed
2	0x2306	PZD5,PZD6	Motor position

Remark Modifications are not saved in the drive EEPROM

Note 1 Error code description:

Error code	Fault description
1	EEPROM parameters checksum
2	EEPROM sequences checksum
3	EEPROM sequences writing
4	Homing time out
5	EEPROM cogging checksum
6	EEPROM parameters writing
10	I ² t
11	Position counting
12	Position following error
13	Bus error
14	Busy (procedure error)
20	Power overvoltage
21	24 Vdc out of range
22	Phase-earth short circuit
23	Braking resistor
24	Fan
25	Holding brake
28	Hall effect sensors / Com. channel
30	IGBT
32	Position sensor
33	Motor overtemperature
35	Power voltage initialisation (only for 400V range)
38	Current sensor offset
39	Overcurrent
40	Undervoltage
50	Not coded fault

Note 2 DC bus voltage monitor scaling: 1000h -> 100V

PZD command mapping

PNU :

829

Modification of the PZD command mapping from PZD3 to PZD6.

Index Byte 3 of PKW = Index of the command signal mapping (index 0 corresponds to the first mappable PZD i.e. PZD3).

Parameter Selection of the command signal to be mapped according to the following values:

Parameter	Command signal	Size
0x22FF	Position set point (see PNU 767)	Double
0x12C9	Current limitation (see PNU 713)	Word
0x12C3	Speed set point (see PZD2 in speed mode)	Word
0x12C4	Current set point (see PZD2 in torque mode)	Word
0x12CA	Speed limitation (see PNU 714)	Word
0x1348	Not affected	Word

A 16 bit command signal (Word) is mapped on 1PZD
A 32 bit command signal (Double) is mapped on 2 PZD

Default value

Index	Parameter	PZD number	Command signal
0	0x1348	PZD3	Not affected
1	0x1348	PZD4	Not affected
2	0x22FF	PZD5, PZD6	Position set point

Remark Modifications are not saved in the drive EEPROM

Regulator parameters

Derivative speed loop gain PNU : 830

Defines the derivative regulator gain (KD) that acts upon the speed feedback.

Parameter 1 word.
Conversion 1
Limitation 0 to 65535

Derivative speed loop gain filter PNU : 831

Defines the time constant of the first order filter (FD) that acts upon the derivative gain.

Parameter 1 word.
Unit ms
Conversion 1/1000
Limitation 0 to 10000

Speed loop gain scaling PNU : 832

This term is acting like a multiplying factor for the feedback regulator gains (KP2, KC, KI, KD, KA, KB) in order to avoid the gain values saturation when the load / motor inertia ratio is very high.

Parameter 1 word.
Conversion 1
Limitation 1 to 1000

Speed measurement filter selection mode PNU : 833

Defines the calculation mode for the speed measurement filter value (PNU 834). This parameter must be set before starting the auto-tuning.

Parameter 1 word.
Limitation 0 - 1
Conversion 0 -> manual setting of speed measurement filter parameter
 1 -> automatic setting of speed measurement filter parameter by auto-tuning.

Speed measurement filter value PNU : 834

Defines the value of the time interval for the motor speed measurement by means of the position difference. This parameter can be calculated by the Auto-tuning procedure (see PNU 833)

Parameter 1 word.
Limitation 0 - 2
Conversion Time Interval for Speed Measurement
 0 -> Time interval for speed measurement = 0.5 ms
 1 -> Time interval for speed measurement = 1 ms
 2 -> Time interval for speed measurement = 2 ms

Note The higher the time interval value, the better the speed measurement resolution but the speed loop gain values must be reduced to maintain the servo loop stability because of the larger speed measurement delay.

Position controller requirement PNU : 837

Defines the position loop requirements for the gain calculation performed by the Auto-tuning procedure. This parameter must be set before starting the auto-tuning.

Parameter 1 word.
Limitation 0 - 1
Conversion 0 -> Minimum tracking error
 1 -> Minimum overshoot

Following error protection

Position Following Error Detection Mode PNU : 838

Defines the operation mode for the position following error protection.

Parameter 1 word.
Limitation 0 - 1
Conversion 0 --> Absolute: this configuration is used for applications with minimum tracking error requirements.
 1 --> Relative to the dynamic model: this configuration is used for applications with minimum overshoot requirements.

Position Following Error Dynamic Gain **PNU :** **839**

This parameter is used for for the position following error protection, operating in the “Relative to the dynamic model” operation mode.

Parameter 1 word.
Conversion 1
Limitation 0 to 32767

Drive configuration

Drive configuration **PNU :** **842**

Parameter 1 word.
 bit description
 4 Analog input reversal for speed limitation
 6 Enable "Phasing OK" signal on the analog output
 7 Enable/Disable analog input for speed limitation
 8 Control word bit 3 (C.3) not operating in torque/speed mode *
 9 Speed / Torque mode saving in the EEPROM
 10 Stop with current limit on ENABLE input desactivation and fault reaction
 others Reserved

(*) for the compatibility with firmware releases lower than 529.D8

Input command selection

Analog input command selection **PNU :** **843**

Defines the input command selection for the Speed operation mode and the Torque operation mode .

Parameter 1 word.
Limitation 0 - 1
Conversion 0 --> Analog input command selection.
 1 --> PROFIBUS (HSW) input command selection.

Monitoring position

Motor position **PNU :** **845**

Reading of the motor position.

Parameter 32 bits

Note position value given by the position sensor mounted on the motor frame.

2nd sensor position **PNU :** **846**

Reading of the 2nd sensor position.

Parameter 32 bits

Note position value given by the secondary position sensor.

Absolute encoder position value

Encoder absolute position resolution **PNU :** **850**

This parameter defines the number of increments for one encoder revolution, in the absolute position channel for a rotary absolute encoder type. For a linear absolute encoder type, this parameter is giving the encoder pitch value in nano-meters for the absolute position channel.

Parameter double word.

Range 512 to 2^{31}

Note Read only parameter. This parameter value is read in the absolute encoder via the communication channel.

Encoder absolute position revolutions **PNU :** **851**

This parameter defines the number of encoder revolutions for a rotary absolute multi-turn encoder.

For a linear encoder or an absolute single-turn encoder, this parameter value is equal to 0.

Parameter word.

Range 0 to 65535 (0 for absolute single-turn encoder or linear encoder)

Note Read only parameter. This parameter value is read in the absolute encoder via the communication channel.

Encoder absolute position value **PNU :** **852**

Reading of the encoder absolute position value, for an absolute encoder type.

Parameter double word.

Range The max. value (modulo) for an absolute single-turn encoder is the [PNU 850](#) value. The max. value (modulo) for an absolute multi-turn encoder is the [PNU 850](#) value x [PNU 851](#) value.

Unit The scaling is given by [PNU 850](#) (number of increments per revolution).

Note This position value is only valid when the encoder is at standstill. When the encoder is moving, this position value is wrong because of the acquisition delay via the encoder communication channel (up to 60 ms).

The polarity of this position depends on the encoder wiring and can be reversed with regard to the polarity of the motor position feedback ([PNU 774](#)). In this case, if necessary, use [PNU 722](#) to reverse the position feedback polarity.

Position range with absolute encoder

Absolute position limit **PNU :** **853**

This parameter defines the maximum value for the absolute position according to the user position resolution ([PNU 740](#)) and the encoder revolutions ([PNU 851](#)) for a rotary absolute encoder. The minimum value for the absolute position is 0. Absolute position control is only possible within these limits. A position roll-over phenomenon occurs when moving beyond these limits. A linear absolute encoder is not concerned by the position roll-over. In this case, the returned value for this parameter is 0xFFFFFFFF (full encoder position range).

Parameter double word.

Range 0 to $2^{32} - 1$

Unit user units (depends on the position resolution)

Note Read only parameter

Absolute encoder reset

Encoder absolute position reset **PNU :** **854**

Parameter None.

Limitation Writing only.

Execution With disabled positioner

Note This procedure allows to set at 0 the encoder absolute position value. The absolute position offset value is calculated accordingly.



With an absolute rotary encoder, this operation must be executed out of the operation travel range in order to avoid absolute position roll-over (see [PNU 853](#)).

Encoder absolute position offset **PNU :** **855**

Reading of the encoder absolute position offset value. This offset value is calculated when the position reset procedure is executed ([PNU 854](#) or [PNU 859](#)).

Parameter double word.

Range The max. value (modulo) for an absolute single-turn encoder is the [PNU 850](#) value. The max. value (modulo) for an absolute multi-turn encoder is the [PNU 850](#) value x [PNU 851](#) value.

Unit The scaling is given by [PNU 850](#) (number of increments per revolution).

User reference position with absolute encoder

User reference position setting **PNU :** **856**

Parameter None.

Limitation Writing only.

Execution With disabled positioner

Note This procedure allows to set and save the user reference position. The user reference position offset value ([PNU 857](#)) is calculated according to the reference position value entered in the [PNU 767](#), and the absolute mode ([PNU 858](#)) is automatically activated. These parameters are automatically saved in the amplifier EEPROM. The homing procedure is no more necessary at the next amplifier power up.



This command must be executed for an absolute encoder inside the operation travel range. The reference position value is entered in [PNU 767](#), in the user units.

User reference position offset **PNU :** **857**

Reading of the user reference position offset value. This offset value is calculated when the user reference position setting procedure is executed (PNU 856) or when a homing sequence is executed.

Parameter double word.
Range 0 to $2^{32} - 1$

Position initialisation mode **PNU :** **858**

Parameter 1 word.
Conversion 0 homing mode.
1 absolute mode (without homing).

Note The absolute mode is automatically activated when the user reference position setting procedure is executed (PNU 856) or when the "save homing" procedure is executed (PNU 860).

Absolute encoder range reset

Encoder absolute position range setting **PNU :** **859**

Parameter None.
Limitation Writing only.
Execution With disabled positioner
Note This procedure allows to set the encoder absolute position value at the centre of the encoder absolute position range. The absolute position offset value is calculated accordingly.



This operation is only valid for an absolute rotary encoder; it must be executed at the median point of the axis travel range. This adjustment allows to overcome the roll-over phenomenon (see PNU 853).

Save homing with absolute encoder

Save homing **PNU :** **860**

Parameter None.
Limitation Writing only.
Execution With disabled positioner
Note This command allows to save the user reference position value after the execution of a homing procedure. The user reference position offset value (PNU 857) and the absolute mode (PNU 858) are automatically saved in the amplifier EEPROM. The homing procedure is no more necessary at the next amplifier power up.

SinCos input error compensation

SinCos inputs error compensation **PNU :** **865**

Parameter None.
Limitation Writing only.
Execution With positioner disabled and **Enable** input activated.
Note This command allows to execute the SinCos inputs error compensation procedure (compensation of the offsets and amplitude difference between the Sin and Cos signals). This procedure is only necessary for a low resolution encoder (number of Sin and Cos periods per revolution less than 128) or a SinCos tracks motor feedback sensor. This operation allows to reduce the motor speed ripples at the Sin and Cos signal frequency (number of Sin and Cos signal periods per revolution x motor speed in rpm / 60) and improve the position accuracy. This operation must be renewed if the motor encoder or the SinCos tracks position sensor is changed for maintenance. The compensation parameters are automatically saved in the amplifier internal memory at the end of the procedure.

Position resolution

Position resolution **PNU :** **870**

This parameter defines the number of position increments for one motor revolution (or one motor pole pitch for a linear motor).

Parameter double word.
Limitation 128 to 65536
Execution With disabled positioner.
Note This position resolution consequently defines the format of both position input command and position feedback.

Warning code

Positioner warning code PNU : 873

Reading of the positioner warning code (from firmware version 52B.68).

Parameter Word

Bit	Meaning	Descriptions
0	reserved	
1	I ² t	I ² t protection
2 to 10	reserved	
11	°C drive	Drive temperature
12	reserved	
13	°C motor	Motor temperature
14	reserved	
15	reserved	


Cogging torque

Cogging torque acquisition PNU : 875

This procedure executes the cogging torque acquisition procedure. The Cogging compensation option available in the Servopac-A amplifier range allows to cancel the motor cogging torque effects for specific applications where torque accuracy higher than 1 % is required. The Servopac-A amplifiers must be factory set for getting the cogging compensation option.

Limitation Writing only.

Execution With ENABLE signal activated, positioner disabled and operating in local mode (bit 10 of the Control Word = 0).

Note  The motor must first be disabled and **uncoupled from the mechanical load**. The ENABLE signal (X4 connector) must also be active. Before executing the procedure, check for free motor shaft rotation over one revolution, that is not dangerous for the operator.

Cogging torque compensation PNU : 876

Parameter 1 word.

Conversion 0 Cogging Torque Compensation disabled
1 Cogging Torque Compensation enabled

Note The cogging torque compensation is only valid if the cogging torque acquisition procedure has been performed before.

Analog input offset & filter

Analog input low-pass filter PNU : 879

Defines the cut-off frequency at -3 dB (Fev) of the first order filter that acts upon the analog input.

Parameter 1 word.

Conversion Frequency (Hz) = 1000/pi*Ln(65536/parameter)

Limitation This parameter can take a value between 2832 (1000 Hz) and 61545 (20 Hz).

Remark The analog input must be selected by the 3 jumpers located on the amplifier connector board.

Analog input offset acquisition PNU : 880

This procedure execute the analog input offset acquisition procedure.

Limitation Writing only.

Remark The analog input must be selected by the 3 jumpers located on the amplifier connector board.

Motor thermal sensor parameters

Motor thermal sensor error threshold PNU : 882

This parameter defines the thermal sensor resistor value at which a motor over-temperature error is triggered.

Parameter word

Conversion The threshold value is defined below:
Threshold = 40958.5 x Rst / (1.2 + Rst)
Rst is the equivalent resistance, in kΩ, of this temperature value.

Motor thermal sensor warning threshold **PNU :** **883**

This parameter defines the thermal sensor resistor value at which a motor temperature warning is displayed.

Parameter word

Conversion The threshold value is defined below:
Threshold = $40958.5 \times Rst / (1.2 + Rst)$

Rst is the equivalent resistance, in k Ω , of this temperature value.

Second position sensor

Second position sensor scaling denominator **PNU :** **884**

This parameter allows to modify the position resolution value on the second sensor input for electronic gearing or second sensor feedback applications.

Parameter word

Range 1 to 65535.

Second position sensor configuration **PNU :** **885**

This parameter allows to close the position loop with the secondary sensor (encoder or resolver according to [PNU 893](#)). Generally, this secondary sensor is on the load.

Parameter word

Conversion See the table below.

Bit Number	Description
0	Position feedback for position loop 0 => motor sensor feedback (resolver or encoder according to PNU 893) 1 => second sensor feedback (encoder or resolver according to PNU 893)
5	2nd Position sensor polarity 0 => multiply by 1 (default) 1 => multiply by -1

Execution With positioner disabled.

Second position sensor scaling numerator **PNU :** **886**

This parameter allows to modify the position resolution value on the second sensor input for electronic gearing or second sensor feedback applications.

Parameter word

Range 1 to 65535.

Encoder Output parameters

Enable encoder output (X3 connector) **PNU :** **887**

This parameter allows to enable the encoder output on the X3 connector for master / slave electronic gearing applications. At the positioner power up, the encoder output on the X3 connector is always disabled.

Parameter word

Range 0-1

Conversion 0 = Encoder Output disabled on the X3 connector
1 = Encoder Output enabled on the X3 connector

Note The TTL encoder input lines and the encoder output lines are located on the same pins of the X3 connector.

Encoder output division ratio **PNU :** **888**

This parameter allows to reduce the encoder output resolution.

Parameter word

Range 1 to 3.

Conversion Encoder Output Division Ratio = n
Division Ratio = $1 / 2^n$

Encoder Output Resolution = ([PNU 750](#) value) x Division Ratio

Note The encoder output only takes into account this parameter after the end of the procedure "encoder output programming".

Encoder output deadband **PNU :** **889**

This parameter introduces a deadband at standstill around the current motor shaft position in order to avoid oscillations of +/- 1 encoder edge on channels A and B.

Parameter word

Range 1 to 4095.

Conversion The value 4095 corresponds to 1/16 of the motor shaft revolution.

Encoder Input parameters

Encoder input selection PNU : 890

This parameter allows to select the encoder type to be connected on the X3 connector.

Parameter word
Range 0 to 15
Conversion see table below

Value	Description
0	TTL incremental encoder configuration
1	TTL incremental encoder + 60° HES configuration
2	TTL incremental encoder + 120° HES configuration
3	SIN/COS incremental encoder configuration
4	SIN/COS incremental encoder + 60° HES configuration
5	SIN/COS incremental encoder + 120° HES configuration
6	Absolute single-turn SIN/COS encoder (ERN1085 compatible)
7	Absolute multi-turn / single-turn SIN/COS encoder with ENDAT protocol
8	Absolute multi-turn / single-turn SIN/COS encoder with HIPERFACE protocol
9	Absolute linear SIN/COS encoder with HIPERFACE protocol
15	Pulse and Direction input configuration for stepper motor emulation

Note The encoder input selection is only valid after the end of the "Motor Feedback Programming" procedure.

Encoder input resolution PNU : 891

Defines the resolution of the encoder mounted on the motor shaft with a motor encoder feedback configuration. Number of encoder pulses per motor revolution (rotary motor) or per motor pole pairs (linear motor) for a TTL encoder type. Number of encoder signal periods per motor revolution (rotary motor) or per motor pole pairs (linear motor) for a SIN/COS encoder type.

Parameter double word
Range 500 to 1000000

Note The encoder input resolution is only valid after the end of the "Motor Feedback Programming" procedure.

Enable encoder interpolation PNU : 892

This command enables the encoder pulse interpolation for a SINCOS encoder type.

Parameter word
Range 0-1
Conversion 0 = No interpolation
 1 = SinCos interpolation (x1024)

Motor feedback selection

Motor feedback selection PNU : 893

The motor feedback sensor is used to close the servo motor torque and speed control loops. The servo motor position loop can be closed either by the motor feedback sensor or by the second sensor (see [PNU 885](#)).

Parameter word
Range 0-1
Conversion 0 = Resolver input selection for the motor feedback (if [PNU 898](#) =0)
 1 = Encoder input selection for the motor feedback (if [PNU 898](#) =0)

Note The motor feedback selection is only valid after the end of the "Motor Feedback Programming" procedure.

Motor feedback programming PNU : 894

The motor feedback programming procedure modifies the encoder input selection and the motor feedback selection according to the parameters defined by [PNU 890](#), [891](#) and [893](#).

Limitation Writing only.
Execution With disabled positioner.
Note The execution of this procedure takes approximately 5 s.

Hall Effect Sensor

Hall Effect Sensor offset

PNU : **895**

This parameter is required for driving synchronous motors. It can be calculated by the auto-phasing procedure.

Parameter phase shift between HES position sensor and motor rotor.

Conversion See table below:

Bit number	Description
0-14	Absolute value of the offset 0 to 7FFFh (0 to 360° electrical degree).
15	Sign of the offset (encoder wiring direct or reverse)

Execution With disabled positioner.

Note This parameter is only valid for "60° HES" or "120° HES" + incremental encoder motor feedback configuration.

Note The HES position sensor, must be correctly adjusted on the motor shaft, by the motor manufacturer, according to the phase commutation positions and the motor pole number.

Motor phasing

Motor phasing

PNU : **896**

Parameter None.

Limitation Writing only.

Note This command starts the motor phasing procedure after the amplifier power up when incremental encoder types without Hall Effect Sensors are used. In this configuration, the motor phasing procedure calculates the phase shift between the position sensor and the motor rotor. The correct number of motor pole pairs, and the correct motor phase order must be saved in the EEPROM in order to successfully execute this procedure .



In the case of an axis with unbalanced load (constant torque due to the gravity effect on a vertical axis), the motor phasing procedure is not valid. The motor must be equipped with an incremental encoder + HES or an absolute Sin/Cos encoder.

Phasing OK output

PNU : **897**

This parameter displays the motor phasing status. When the motor phasing is not OK, the servo motor cannot be enabled

Parameter word

Range 0-1

Conversion 0 = motor phasing not OK
1 = motor phasing OK

SinCos tracks motor feedback

SinCos tracks motor feedback selection

PNU : **898**

The SinCos tracks motor feedback is used to close the servo motor torque and speed control loops. The servo motor position loop can be closed either by the motor feedback sensor or by the second sensor (see [PNU 885](#)).

Parameter word

Range 0-1

Conversion 0 = Resolver or encoder input selection for the motor feedback according to [PNU 893](#) value
1 = SinCos tracks input selection for the motor feedback

Note The motor feedback selection is only valid after the end of the "Motor Feedback Programmation" procedure.

Specific function activation

Specific function activation

PNU : **899**

This parameter allows to activate a specific function into the TTA-PRO servo drive.

Parameter Word

Conversion

bit	description
0	Warning on software limit switch (from firmware version 52B.48)
1	Warning on motor temperature (from firmware version 52B.68)
2	Warning on drive temperature (from firmware version 52B.68)
3	Warning on I ² t protection (from firmware version 52B.68)
4 to 15	Reserved

Note This parameter is not saved in the drive EEPROM.
 The default value at the drive power up = 0.

If bit 0 of the PNU 899 is set to 1, bit 7 (Warning) of the status word (PZD1) is set when the software limit switches are activated.

If bit 1 of the PNU 899 is set to 1, bit 7 (Warning) of the status word (PZD1) is set when the motor temperature warning is released.

If bit 2 of the PNU 899 is set to 1, bit 7 (Warning) of the status word (PZD1) is set when the drive temperature warning is released.

If bit 3 of the PNU 899 is set to 1, bit 7 (Warning) of the status word (PZD1) is set when the I²t protection warning is released.