electroinvent

AC Servo Drives ELAS

Applications

AC servo drives for CNC machines
AC servo drives for Robotics
Multioperational machines
Position control
Printing/Press machines
Food industry
Factory automation
Packing machines
etc.

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Thank you very much for your right choice to use ELECTROINVENT servo drives series ELAS.

This ELAS servo drives manual will be helpful in the installation, wiring, inspection, running in operation and maintenance of the servo drives.

Before using the product, please read this user manual to ensure correct use.

Place this user manual in a safe location for future reference.

- **Contents of this manual**

This manual provides full information about requirements of installation, initial run and operation with servo drives ELAS, intended to work with brushless el. motors. The main topics in this manual are:

- Unpacking check and model explanation
- Installation and storage
- Connecting
- Configuration software
- Initial run and tuning
- Operation modes and functions
- Parameters
- MODBUS communications
- Maintenance
- Troubleshooting
- Specifications

- **Purpose of this manual**

This user manual is intended for the following users:

- Designers of machines and installations.
- Specialists, responsible for installing and wiring of servo drives.
- Specialists, responsible for running in operation, programming and adjustment.
- Specialists, responsible for maintenance and troubleshooting.

- **Description of important symbols used in this manual:**

ATTENTION: **Pay attention on the written in this manual**

ATTENTION
Use protection earthing!
See Operation manual

DANGEROUS
Capacitors remain under dangerous voltage!
Time for discharge 5 minutes

ATTENTION
Danger for burning!
Cover can be hot.

Chapter 1 Unpacking Check and Model Explanation

1.1. Unpacking Check

After receiving the ELAS AC servo drive, please check for the following:

- Ensure that the product is the same you have ordered.

Verify the product type, indicated on the nameplate, corresponds with the model you have ordered (Please, refer to Section 1.2 for details about the model explanation).

- Check for damage.

Verify the servo drive about eventual damage during transportation. If there are damaged or not corresponding parts, please, inform the producer – Electroinvent Ltd or distributor, from whom you have purchased the product.

The delivered AC servo drive set is:

- AC servo drive type ELAS
- CN3 connector: 28 pins - WAGO Connector
- CN4 connector: 16 pins - WAGO Connector
- CN1 connector: 8 pins (RJ45 Cable Mount Connector)

Optionally can be ordered:

- Four conductors power cable (type H05VV-F) with section according to Table 1, Table 2 A and Table 2 B in chapter 3, to connect the servo motor to U, V, W terminals of the servo unit.
- Shielded cable (type LICHY.8 x 2 x 0.25) to connect the encoder on the servo motor with the connector CN4 on the servo unit.

1.2. Servo drive model explanation

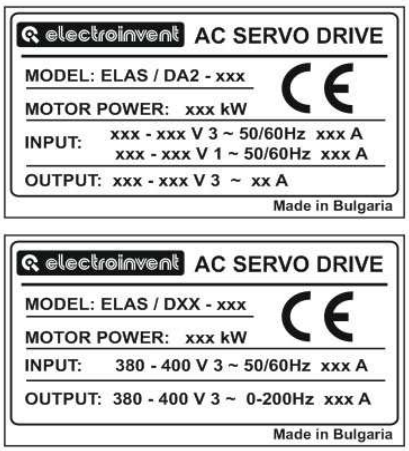
The series AC servo drives ELAS is intended to drive AC servo motors. They are completed with brushless synchronous electrical motors with permanent magnets in the range from 0,55 кW to 11,0 kW and are intended to control high precision machine tools, robots and complete positioning systems.

The series is designed in 3 sizes: DA ; DB ; DC;
It is designed for the following voltage supplies and motors power:

- 200 - 230V 1 ~ 50/60Hz – motor power 0,55kW to 1,1 кW
- 200 - 230V 3 ~ 50/60Hz – motor power 0,55kW to 5,5 кW
- 380 - 400V 3 ~ 50/60Hz – motor power 0,75kW to 11,0 кW

1.2.1. Explanation of the technical data on the units label:

Servo drive model:
Power of the driven motor:
Supply voltage / current:
Output voltage / current:



1.2.2. Configuration of servo drive type:

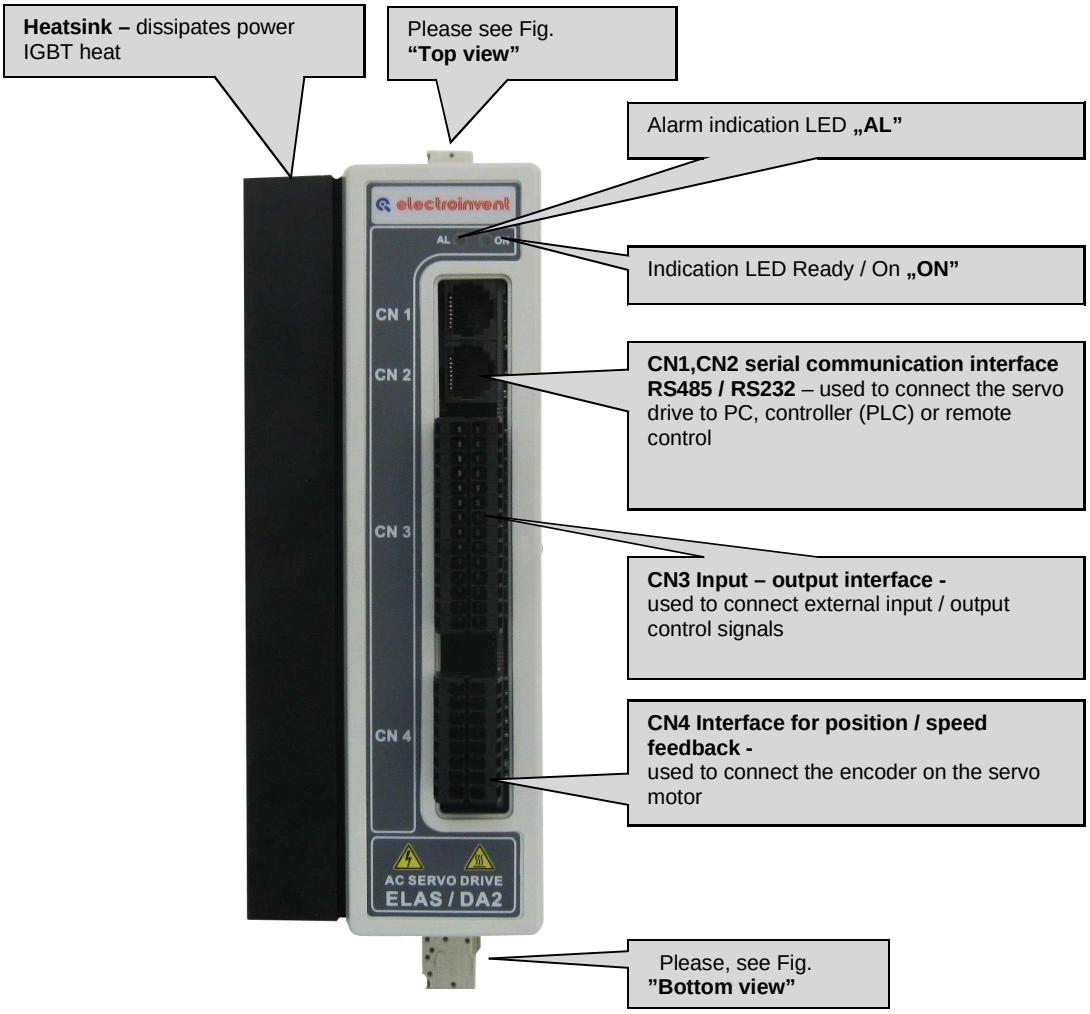
ELAS	–	X X X	–	X	X	–	X X X	–	X
Series		Version / Size		Power Supply			Motor power , kW		Feedback
				Number of Phases	Voltage				
ELAS		DA2 ; DA4 DB2 ; DB4 DC2 ; DC4		1 3	2 - 230V 4 - 400V		002 - 0,2 kW ..... 110 - 11 kW		E - Encoder T - Tacho /

1.3. Basic technical parameters of AC servo drives ELAS

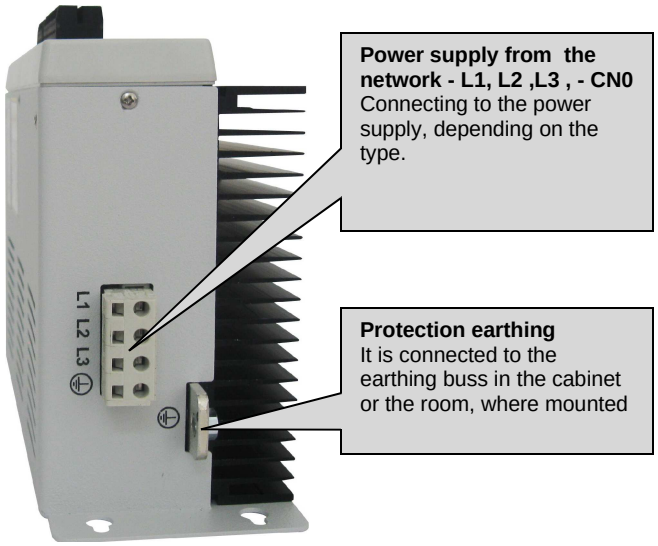
Type	ELAS	DA2			DB2		DC2			DA4				DB4		DC4		
Motor power	kW	0,55	0,75	1,1	1,5	2,2	3,0	4,0	5,5	0,75	1,1	1,5	2,2	3,0	4,0	5,5	7,5	11
Supply voltage and frequency		200÷230V3~50/60Hz			200 ÷ 230 V 3 ~ 50/60Hz					380 ÷ 400 V 3 ~ 50/60Hz								
Rated output voltage	VAC	200 ÷ 230 V 3 ~ 0 ÷ 200 Hz (corresponds to the input voltage)								380 ÷ 400 V 3 ~ 0 ÷ 200 Hz (corresponds to the input voltage)								
Nominal output current	A	3,5	5	6,5	7,5	10	15	20	25	2,5	4	5,5	7	8	10	12	20	25
Maximum output current	A	10	10	15	15	25	50	50	75	10	10	15	15	25	25	25	50	75
Motor control methods		SVPWM (SPACE VECTOR PULSE WIDTH MODULATION) CONTROL; SIN PWM																
Brake resistor		Built in (50Ω / 100W)			No					Built in (50Ω / 100W)				No				
Protective structure		IP 20																
Cooling system		No			Fan cooling					No				Fan cooling				
Protections		Overcurrent, Overvoltage, Undervoltage, Servo Overheat, Regeneration error, Overload, Encoder error, IPM fault, Communication error and other																
Operating temperature		0°C to 55°C (If Operation temperature above specified range, forced cooling will be required)																
Storage temperature		-20°C ÷ +65°C																
Humidity		80% at 30°C (non-condensing)																

Type		ELAS	DA2			DB2		DC2			DA4				DB4		DC4		
Motor power		kW	0,55	0,75	1,1	1,5	2,2	3,0	4,0	5,5	0,75	1,1	1,5	2,2	3,0	4,0	5,5	7,5	11
Supply voltage and frequency			200÷230V3~50/60Hz			200 ÷ 230 V 3 ~ 50/60Hz					380 ÷ 400 V 3 ~ 50/60Hz								
Rated output voltage		VAC	200 ÷ 230 V 3 ~ 0 ÷ 200 Hz (corresponds to the input voltage)								380 ÷ 400 V 3 ~ 0 ÷ 200 Hz (corresponds to the input voltage)								
Nominal output current		A	3,5	5	6,5	7,5	10	15	20	25	2,5	4	5,5	7	8	10	12	20	25
Maximum output current		A	10	10	15	15	25	50	50	75	10	10	15	15	25	25	25	50	75
Motor control methods			SVPWM (SPACE VECTOR PULSE WIDTH MODULATION) CONTROL; SIN PWM																
Brake resistor			Built in (50Ω / 100W)			No					Built in (50Ω / 100W)				No				
Protective structure			IP 20																
Cooling system			No			Fan cooling					No				Fan cooling				
Speed Control Mode																			
Analog Command Input V-REF multifunctional	Voltage Range	VDC	0 ÷ +/-10VDC																
	Input Resistance	Ω	10KΩ																
Speed Control Range			1 ÷ 5000																
Torque Limit Operation			Set by parameters or via analog input																
Command Source			External analog signal / Internal parameters																
Speed Accuracy (at Rated Rotation Speed)			0.01% or less at load fluctuation 0 - 100%																
			0.01% or less at power fluctuation +/-10%																
			0.01% or less at ambient temperature fluctuation 0 - 50°C																
Position Control Mode																			
Max Input Pulse Frequency			Max 500Kpps (Line driver) / Max 200Kpps (Open collector)																
Pulse Type			Pulse + Direction; (Aphase + Bphase; CCW Pulse + CW Pulse - optional)																
Command Source			External (pulse train) / Internal (parameters)																
Electronic Gear			Electronic Gear A/B multiple (-199.00 <A/B<199.00)																
Torque Limit Operation			Set by parameters or via analog input																
Torque Control Mode																			
Analog Command Input T-REF multifunctional	Voltage Range	VDC	0 ÷ +/-10VDC																
	Input Resistance	kΩ	10kΩ																
	Time Constant	µS	2.2µS																
Speed Limit Operation			Set by parameters or via analog input																
Command Source			External (analog signal) / Internal (parameters)																
Input-output interface and protections																			
Digital Inputs			5 multifunctional programmable. Optoisolated. NPN																
Digital Outputs			3 transistor "Open collector" multifunctional programmable, 3 differential encoder signal output A/B/Z - Line Driver																
Communication Interface			RS 232 / RS 485																
Protections			Overcurrent, Overvoltage, Undervoltage, Servo Overheat, Regeneration error, Overload, Encoder error, IPM fault, Communication error and other																
Working and Storage Environment																			
Operating temperature			0°C to 55°C (If Operation temperature above specified range, forced cooling will be required)																
Storage temperature			-20°C ÷ +65°C																
Humidity			80% at 30°C (non-condensing)																

1.4. Features of AC servo drives series ELAS



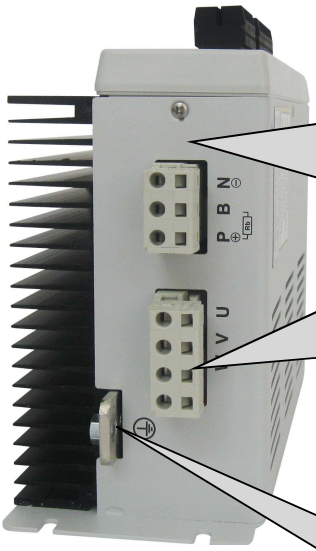
Top view



Power supply from the network - L1, L2 ,L3 , - CN0 Connecting to the power supply, depending on the type.

Protection earthing It is connected to the earthing buss in the cabinet or the room, where mounted

Bottom view



Connection of external braking resistor (P, B, E) - CN5. If used external resistor connect between (**P - B**). If used external braking unit connect between (**P- E**).

Supplying servo motor (U,V,W)- CN6 Connection to the servo motor! **Never** connect these terminals to mains power supply!

Protection earthing to el. motor frame . It is connected to the servo motor!

1.5. Control Modes of Servo Drive

AC servo drives series ELAS are intended to control the speed, position and torque of the servo motors (brushless synchronous motors with permanent magnets). Depending on control setting can be programmed and executed six single and three double modes of operation. Their mode of operation is shown in the table below.

Operation mode		Code	Description
Single modes	External position control	**Pt** P1-00 (CTM) = 0	Servo drive is configured in this mode when the reference for position/speed are two pulse sequences (Step/Direction), entering from external controller (PLC). The first pulse frequency determines the speed reference, and the number of pulse fronts determines position reference. The logical level of second sequence determines direction reference.
	Internal position control	**Pr** P1-00 (CTM) = 3	The servo drive is configured in this mode, when the position is referenced : ➢ by Modbus serial interface (COM port). ➢ by digital inputs (DI). (internally by parameters can be set up to 7 positions).
	Speed control	**S** P1-00(CTM) = 1	The servo drive is configured in this mode, when the speed is referenced: ➢ by Modbus serial interface (COM port). ➢ by digital inputs (DI). (internally by parameters can be set up to 7 speed references). ➢ by analog input (V-REF / GNDA). -10 VDC to +10 VDC.
		Sz P1-00 (CTM) = 11	The servo drive is configured in this mode, when the speed is referenced: ➢ by digital inputs (DI). (internally by parameters can be set up to 7 speed references).
	Torque control	**T** P1-00 (CTM) = 2	The servo drive is configured in this mode, when the torque is referenced: ➢ by digital inputs (DI). (internally by parameters can be set up to 7 torque references). ➢ by analog input (T-REF / GNDA). -10 VDC до +10 VDC.
		Tz P1-00 (CTM) =12	The servo drive is configured in this mode, when the torque is referenced: ➢ (internally by parameters can be set up to 7 torque references).
	Adjustment of absolute rotor position	**ARP** P1-00 (CTM) = 5	The servo drive is configured in this mode initially to adjust the servo drive to the used motor P1-15 (RPO)
Dual modes		**SW-Pt** DINx = 18	Switching to **Pt** control mode can be selected by digital input (DINx = 18).
		SW-Pr DINx = 19	Switching to **Pr** control mode can be selected by digital input (DINx = 19).
		SW-S DINx = 20	Switching to **S** control mode can be selected by digital input (DINx = 20).

2.1. Installation instruction

By installation of AC servo drive must be observed the following requirements:

- By installation carefully unpack and take out the product from the packing;
- Install the AC servo drive in an electrical cabinet;
- Assemble the drive on mounting surface with enough strength and hardness;
- Assemble the drive on non-flammable surfaces;
- Assemble the drive with suitable fixing parts, using instruments, which can guarantee the mechanical exertion;
- Assemble the drive in this way, that the access for operation, adjustment and service is guaranteed.
- Don't bend or strain the connection cables between servo drive and motor;
- When assemble the drive, check the fixing screws to be good tighten;
- The servo drives are intended to work with electrical motors which meet IEC 60034-1 requirements;
- The built-in motor sensors and connected to the servo unit, must have secured by wiring double and/or strengthened insulation between them and current conducting parts of the motor. The insulation must be calculated for working voltage 400VAC;
- If the motor is coupled directly to the driven object, check the motor to be connected to the servo unit correctly;
- If the cable length between the motor and servo unit is bigger than 20m, increase the power cable section, connecting the motor with servo unit, as well as the encoder cable to the servo unit.
- Check if the motor fixing screws are tighten well.

2.2. Transport and storage conditions

- The ambient temperature: -20°C to +65°C.
- Air humidity: from 0% to 90% (without moisture condensing)
- The units should not be exposed on influence of impacts, vibrations, UV radiating.
- The units to be stored in dry and clean location without direct sunlight;
- The units to be stored in location without corrosive gases and liquids, packed well and placed on solid surface;
- The units to be stored in transport package until installed.

To preserve the guarantee, the servo drive must be stored correctly

2.3. Operation conditions

- Operating temperature: +5°C to +45°C
- Air humidity: 80% by 30°C (without condense) decreasing linearly to 40% by 30°C
- Altitude: till 2000m
- Over voltage class: III
- Pollution degree (environment): 2
- Protection class against electrical shock damage: I
- Type of power supply system: TN
- Environment: explosion-proved, absence of current conducting particles, gases and vapors in concentration with damaging effect.

Nominal output power should be decreased with 1% on each 100м by assembling above 1000 м (for example by 1500m; Pout = 0,95 Pnom).
If the ambient temperature of AC drive is more than 45°C, install the drive on well ventilated place, without obstruction of the cooling fan airflow.

Attention: Servo drive and motor emit heat.

It is necessary to ensure sufficient space between servo drives and other units in the electrical cabinet to dissipate the heat.

Take special care about vibrations and check if vibrations don't influence over the electrical devices in the cabinet.

Observe the following rules when choose the place for installation.

- Don't install the servo drive close to heat emitting elements or directly to the sun shine;
- Don't install the servo drive on place subjected to corrosive gases, liquids, or dust in the air or metal micro particles;
- Don't install on places, where the temperature and humidity exceed specified;
- Don't install the servo drive on places, where it will be subjected on a high level of electromagnetic radiation.

Attention: If you don't observe this requirements you can loose your guarantee!

2.4. Installation procedure and minimum clearances

Installation

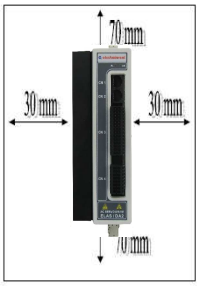
Incorrect installation may result in a drive malfunction or premature failure of the servo unit. Please follow the instructions in this manual when installing the servo drive. The servo unit should be mounted perpendicularly to the wall of the cabinet or to the control panel. In order to ensure good ventilation, check that the all ventilation holes are not obstructed and there is sufficient free space around the servo drive. Do not install the drive in horizontal position or malfunction and damage will occur.

Correct

Incorrect

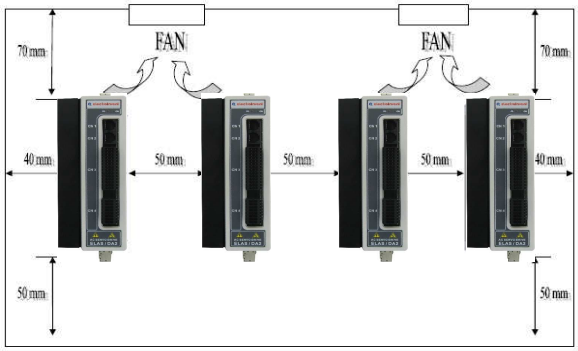
Servo drive mounting

The servo drive must be mounted vertically with its back to the wall on dry and hard surface. Minimum 70 mm to be left below and above it for ventilation and heat dissipation.



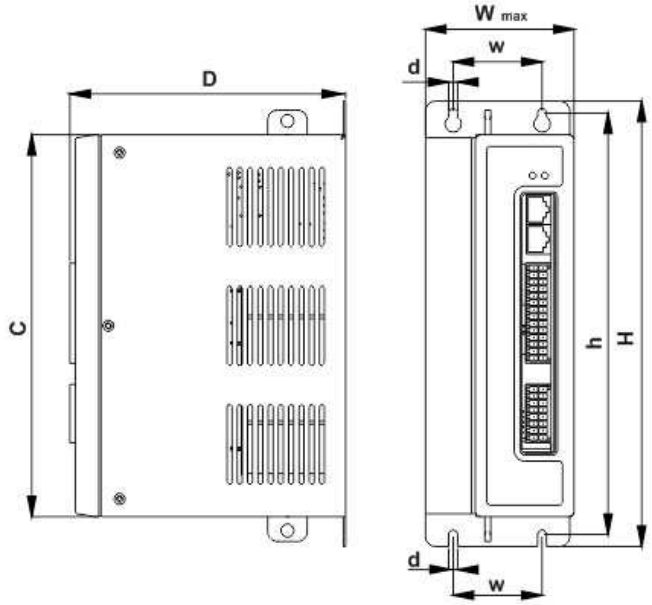
Minimum clearances

Install a fan to avoid ambient temperatures, exceeding the specified. When installing two or more drives adjacent to each other, please, follow the clearances as shown in the following diagram.



2.5. Overall and fixing dimensions

Overall and fixing dimensions of servo drives series ELAS are shown in the table below:



Type / kW	H, mm	Wmax, mm	D, mm	C, mm	h, mm	w, mm	d, mm
ELAS-DA2-005	225	75	150	193	215	45	4,5
ELAS-DA2-007	225	75	150	193	215	45	4,5
ELAS-DA2-011	225	75	150	193	215	45	4,5
ELAS-DB2-015	260	93	210	220	248	70	6
ELAS-DB2-022	260	93	210	220	248	70	6
ELAS-DC2-030	328	116	245	278	310	80	6,5
ELAS-DC2-040	328	116	245	278	310	80	6,5
ELAS-DC2-055	328	116	245	278	310	80	6,5
ELAS-DA4-007	225	75	150	193	215	45	4,5
ELAS-DA4-011	225	75	150	193	215	45	4,5
ELAS-DA4-015	225	75	150	193	215	45	4,5
ELAS-DA4-022	225	75	150	193	215	45	4,5
ELAS-DB4-030	260	93	210	220	248	70	6
ELAS-DB4-040	260	93	210	220	248	70	6
ELAS-DC4-055	328	116	245	278	310	80	6,5
ELAS-DC4-075	328	116	245	278	310	80	6,5
ELAS-DC4-110	328	116	245	278	310	80	6,5

This chapter provides information on wiring ELAS series products, the descriptions of I/O signals and gives typical examples of wiring diagrams.

3.1. Connectors

3.1.1. Connecting to peripheral devices

3.1.2. Description of servo drives connectors

Symbol	Explanation	Function	
CN0 **L1, L2, L3**	Power mains supply	It is used to supply the servo drive from the el. network. By single-phase supply, connect terminals L1 and L2(N) (200-240VAC) – by single phase line supply – L1 and L2; – by single phase supply L1 and N If 3-phase supply, connect terminals L1; L2 и L3 (200-240 VAC or 380-400 VAC).	
CN0 	Functional earthing	It is used for functional earthing of the servo drive to the earthing bolt of the el. cabinet or to the protecting circuit of building installation	
Earthing 	Protective earthing	For protective earthing of servo drive frame	
CN6 **U, V, W**	Motor supply	For connecting between servo drive and servo motor.	
Earthing 	Protective earthing	For protective earthing of servo motor frame.	
CN5 **P, B, E**	Brake resistor	Internal resistor	For model DA2 and DA4 – built-in internal break resistor
		External resistor	External break resistor is connected to terminals P and B.
		External breaking unit	External breaking unit is connected to terminals P и E.
CN1, CN2	Serial communication interface	For connection to personal computer or other devises.	
CN3	Input-output interface	For connecting of external input/output signals.	
CN4	Position/speed feedback interface	For connecting of encoder on the servo motor.	

Wiring notes:
For safety work the following rules must be observed:

- All used connectors are performed in accordance with requirements for protective division.
- Terminal connectors of the unit are not intended to separate under load.
- Check the correct connecting to mains power supply (L1,L2,L3, ⏚).

Check the correct connecting of protective earthing ⏚ of the servo drive with earthing bolt in the cabinet or to the protective circuit of building installation.

- For the unit the touching current in the earthing conductor doesn't exceed the critical value of 3,5 mA AC.
- By installation of these units it is not suitable to use defect-current protection.
- Check about correct connection of the servo motor to the connector (U, V, W).
- Check about correct connection of protective earthing ⏚ of the el. motor to earthing bolt ⏚ of the servo unit.
- Pay attention by installation, operation and service of the servo drive, that the terminals of power circuits connectors are parts under dangerous voltage and additional measures must be taken for safety work with them or near to them.
- To decrease the electrical noise and disturbances use shielded cable with twisted pairs of cores for wiring of encoder signals.

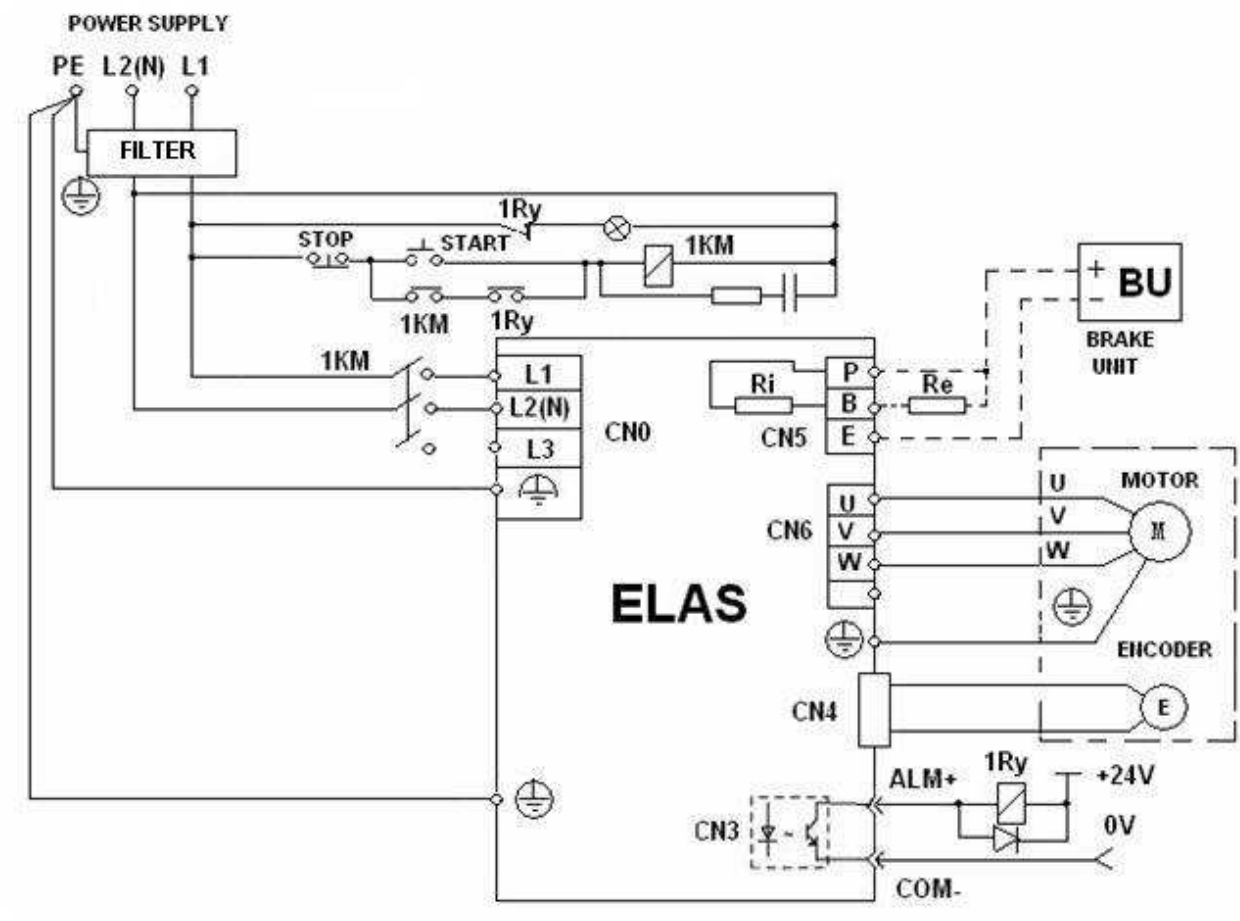
After switch-off of power supply it is necessary to wait minimum 5 min. before starting of assembling or disassembling the power input/output connectors. The time is necessary to discharge the capacitors in the power unit.

- Power cables (L1, L2, L3, U, V, W, ⏚, ⏚) to be placed in a cable conduit, separately from signal cables of input/output interface and encoder.
- Use connecting cables with cross section shown in Table 1, Table 2.A and Table 2.B in this chapter 3. Use only cables with double insulation, in conformity with operating voltages of the system (for example HOSVV-F or type HO5RR-F).
- For connecting of protective earthing ⏚ use only yellow-green cables with double insulation, in conformity with operating voltages of the system (for example HOSVV-F or type HO5RR-F).
- Concerning the choice of conductors cross section of the cables for power supply from the mains and to the motor, use cables with cross section in accordance with Table 1, Table 2.A and Table 2.B.
- The built-in the motor temperature contact sensors can be connected to programmable digital input of the servo drive, which will switch-off the servo unit and will register “ALARM”.
- There are taken special protection measures regarding accessible control circuits, operating at safety over low voltage (SELV). These measures include protective separation of all control circuits from power circuits under dangerous voltage by double strengthened insulation, calculated for over voltage category III and maximum operating voltages 400V or 230V in the units.
- It is necessary the protective separation to be preserved by assembling, operation and service of the system with suitable separation of power and operative circuits, usage of cables and connectors with suitable double strengthened insulation and observing the specified climatic and temperature requirements.

3.1.3. Wiring methods

3.1.3.1. Connection diagram with single power supply 200-230 V 1~ 50/60Hz:

For model DA2 (with power 0.55 kW; 0.75 kW and 1.1kW)

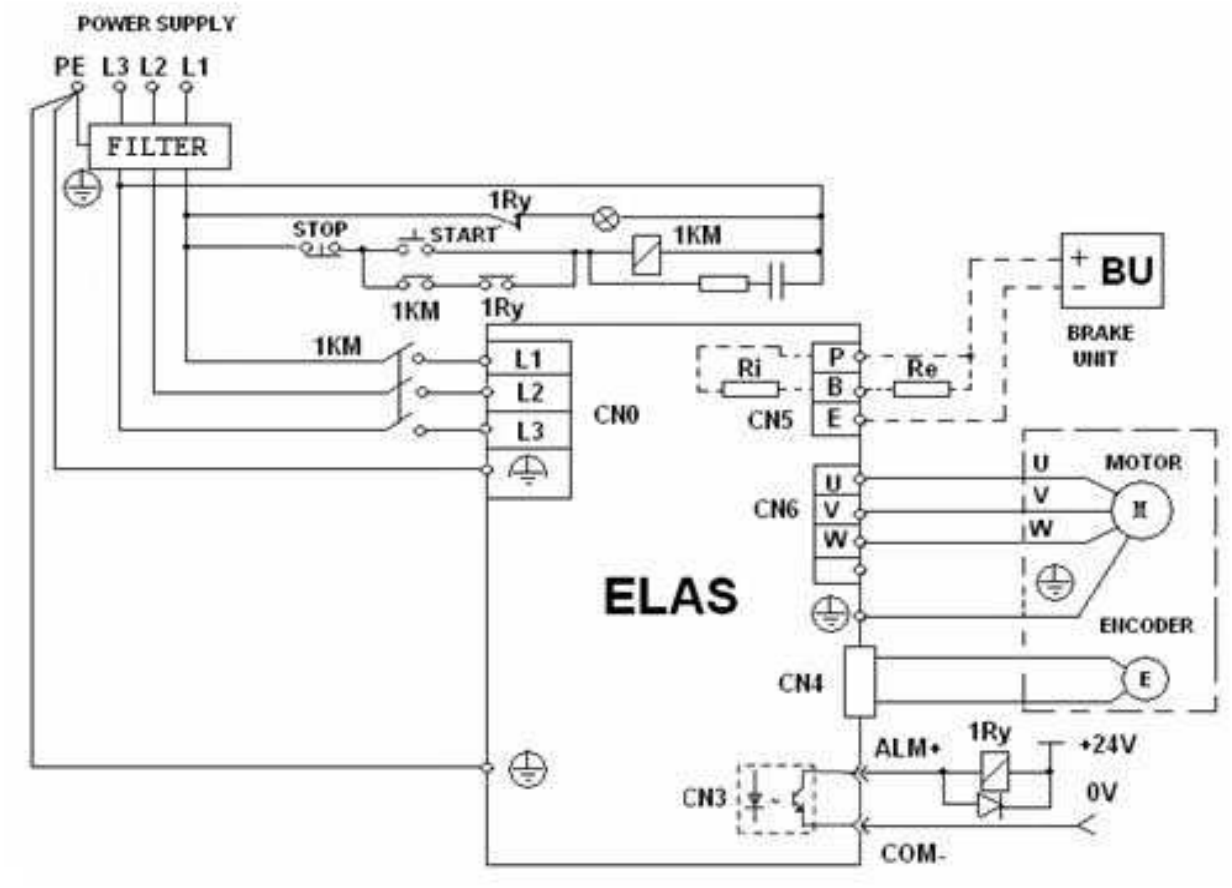


Cross section of connecting cables and conductors on connection diagram 3.1.3.1. are in accordance with Table 1:

Table 1

Model		DA2		
Motor power [P]	[kW]	0,55	0,75	1,1
Input – power supply L1,L2 (N),	мм^2	1,0	1,5	1,5
Functional earthing ⏚	мм^2	1,0	1,5	1,5
Protective earthing of servo drive ⏚	мм^2	1,0	1,5	1,5
Output – connecting to servo motor (U,V,W)	мм^2	1,0	1,5	1,5
Protective earthing of servo motor ⏚	мм^2	1,0	1,5	1,5
Short circuit current of input automate, type „C” , not less than 10кА	[A]	4	6	10

3.1.3.2. Connection diagram with three-phase power supply 200-230V 3 ~ 50/60Hz :
For model DA2, DB2 and DC2 (with power from 0.55 kW to 5.5 kW)

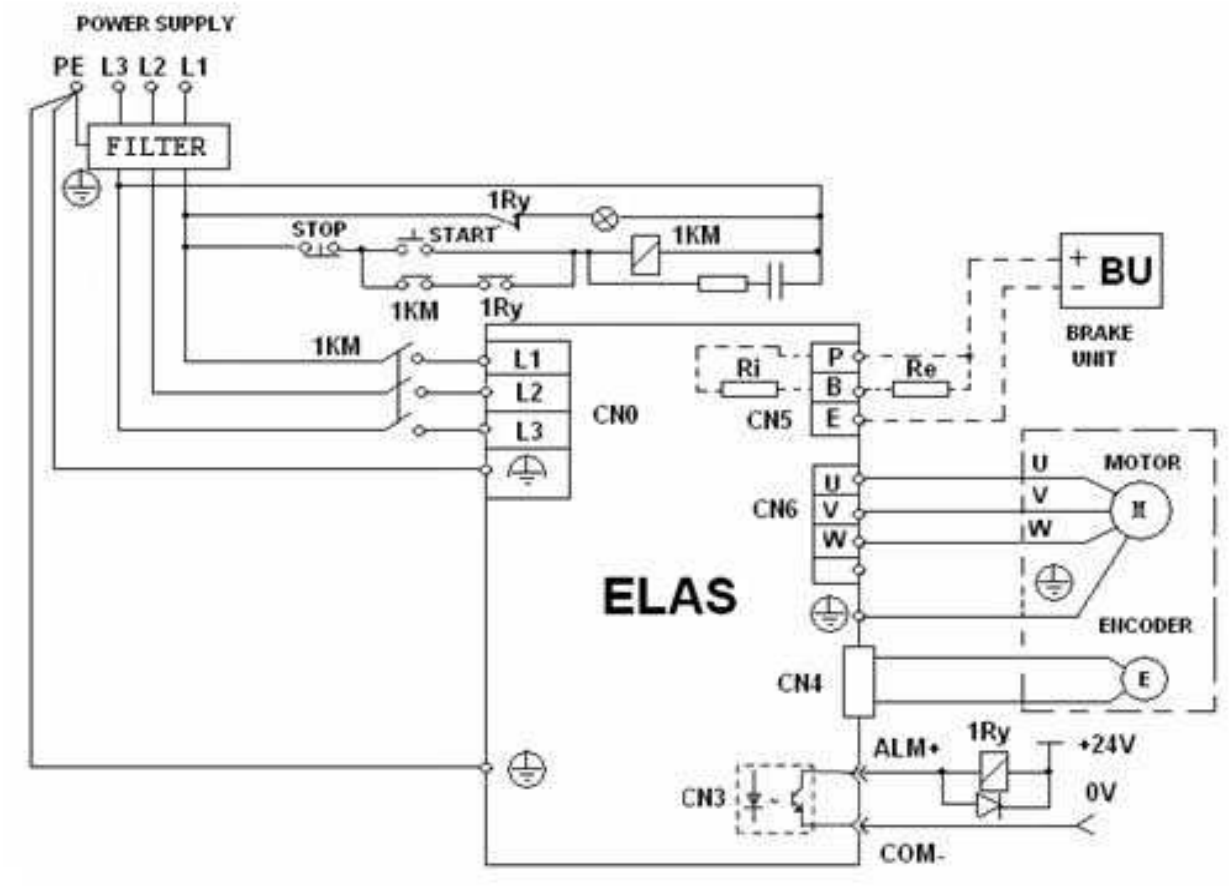


Cross section of connecting cables and conductors on connection diagram 3.1.3.2. are in accordance with Table 2.A:

Table 2.A

Model		DA2			DB2		DC2		
Motor power [P]	[kW]	0,55	0,75	1,1	1,5	2,2	3,0	4,0	5,5
Input – power supply (L1,L2,L3)	мм^2	1,0	1,5	1,5	2,5	2,5	2,5	2,5	2,5
Functional earthing ⏚	мм^2	1,0	1,5	1,5	2,5	2,5	2,5	2,5	2,5
Protective earthing of servo drive ⏚	мм^2	1,0	1,5	1,5	2,5	2,5	2,5	2,5	2,5
Output – connecting to servo motor (U,V,W)	мм^2	1,0	1,5	1,5	2,5	2,5	2,5	2,5	2,5
Protective earthing of servo motor ⏚	мм^2	1,0	1,5	1,5	2,5	2,5	2,5	2,5	2,5
Short circuit current of input automate, type „C” , not less than 10кA	[A]	4	6	10	10	16	16	16	20

3.1.3.3. Connection diagram with three-phase power supply 380-400 V 3 ~ 50/60Hz : For model DA4, DB4 и DC4 (with power from 0.75 kW to 11.0 kW)



Cross section of connecting cables and conductors on connection diagram 3.1.3.3. are in accordance with Table 2.B:

Table 2.B

Model		DA4				DB4		DC4		
Motor power [P]	[kW]	0,75	1,1	1,5	2,2	3,0	4,0	5,5	7,5	11,0
Input – power supply (L1,L2,L3)	мм^2	1,5	1,5	2,5	2,5	2,5	2,5	2,5	4,0	6,0
Functional earthing ⏚	мм^2	1,5	1,5	2,5	2,5	2,5	2,5	2,5	4,0	6,0
Protective earthing of servo drive ⏚	мм^2	1,5	1,5	2,5	2,5	2,5	2,5	2,5	4,0	6,0
Output – connecting to servo motor (U,V,W)	мм^2	1,5	1,5	2,5	2,5	2,5	2,5	2,5	4,0	6,0
Protective earthing of servo motor ⏚	мм^2	1,5	1,5	2,5	2,5	2,5	2,5	2,5	4,0	6,0
Short circuit current of input automate, type „C” , not less than 10кА	[A]	4	6	6	10	16	16	20	25	40

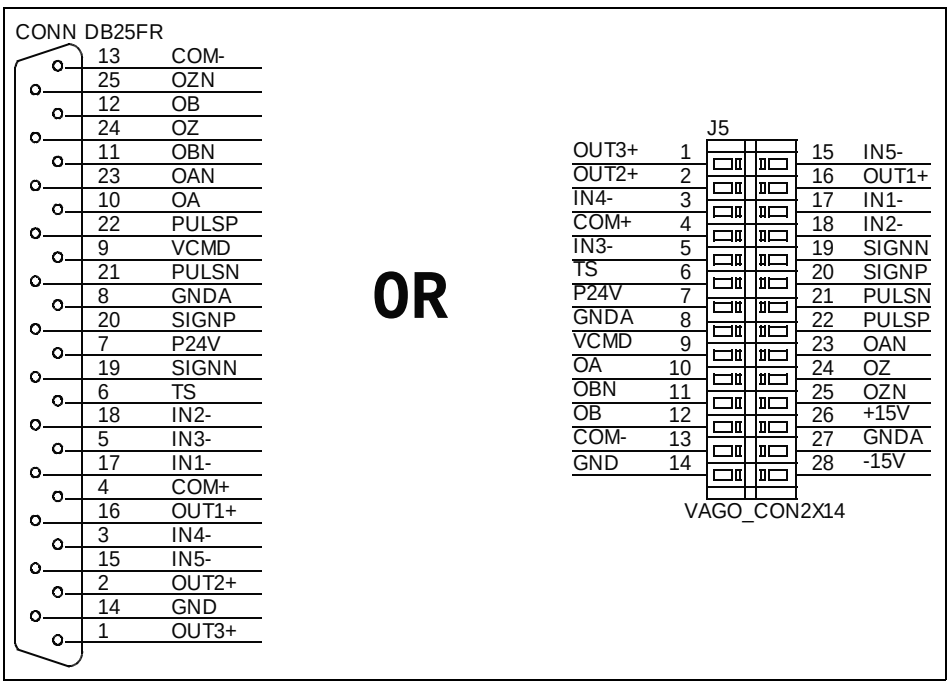
3.2. Connector CN3 – input/output interface

Connector CN3 allows access to following groups of input/output signals:

- 5 + 2 programmable digital inputs, set by parameters P2-01 to P2-07;
- 3 programmable digital outputs (DO), set by parameters P2-08 to P2-10;
- 2 programmable analog inputs (AI), set by parameters P2-11, P2-14;

3.2.1. Connector CN3

Wiring of connector/terminal block CN3: (type A or type B)



Pin	Name	Explanation	Pin	Name	Explanation
1	OUT3+	Digital output	15	IN5-	Digital input
2	OUT2+	Digital output	16	OUT1+	Digital output
3	IN4-	Digital input	17	IN1-	Digital input
4	COM+	Common terminal on dig. inputs	18	IN2-	Digital input
5	IN3-	Digital input	19	SIGNN	Input position direction (-)
6	T-REF	Analog input, “torque reference” (+)	20	SIGNP	Input position direction (+)
7	P24V (VDD)	Supporting voltage P24V for input/output signals	21	PULSN	Input position step (-)
8	GNDA	Analog ground	22	PULSP	Input position step (+)
9	V-REF	Analog input „speed reference" (+)	23	OAN	Encoder AN pulse output
10	OA	Encoder A pulse output	24	OZ	Encoder Z pulse output
11	OBN	Encoder BN pulse output	25	OZN	Encoder ZN pulse output
12	OB	Encoder B pulse output	26	+12V	Supporting voltage (+) 50mA
13	COM-	Common terminal for digital outputs	27	GNDA	Analog ground
14	GND	Ground of supply P24V	28	-12V	Supporting voltage (-) 50mA

3.2.2. Signal explanation of connector CN3

Tables 3.A, 3.B, 3.C and 3.D explain in details the four groups of signals on CN3.
Table 3.A explains the common signals and corresponding wiring circuits.
Table 3.B explains the functions on digital inputs (D1).
Table 3.C explains the functions on digital outputs (DO).
Table 3.D explains the functions on analog inputs (AIN).
The digital and analog inputs are multifunctional. The pulse inputs and outputs from the encoder are factory set and can not be changed, programmed or adjusted.

Table 3.A Common signals.

Signal		Terminal	Wiring circuit	Explanations
Input analog signals	V_REF	9	C1	Motor speed reference: -10V до +10V, corresponds to the maximal speed of motor rotation.
	T_REF	6		Motor torque reference: -10V до +10V, corresponds to -100% до +100% of rated torque of the motor
	GNDA	8		Common ground of input analog signals
Input pulse sequences for position reference	PULS /PULS SIGN /SIGN	22 21 20 19	C2/C3	Servo drive can accept two different types of input pulses: open collector and active output. Regime step/direction can be chosen by these inputs.
Output signals from encoder	OA OAN	10 23	C7	The encoder signals are taken out on these terminals. Output sequences A, B, Z are type Line Driver.
	OB OBN	12 11		
	OZ OZN	24 25		
Digital inputs	IN1- IN2- IN3- IN4- IN5-	17 18 5 3 15	C6	Multifunctional digital inputs (Table 3.B)
Digital outputs	OUT1+ OUT2+ OUT3+	16 2 1	C4,C5	Multifunctional digital outputs (Table 3.C)
Power supply	P24V (VDD)	7	C4,C5,C6	VDD power supply +24V from servo drive. Maximum allowed consumption current 300mA.
	COM+ COM-	4 13		COM+ is a common voltage bus of digital input/output signals. By regime of internal applied supply connect VDD to COM+. By regime of applied external supply (+12V to +24V), the positive terminal must be connected to COM+ and negative to COM-.
	GND	14		Common ground of 24V supply
Supporting voltages	+15V GNDA -15V	26 27 28		Source of supporting voltage available only for terminal block type B. The maximum allowed consumption current 100mA.

The digital inputs (DI), digital outputs (DO) and analog inputs (AI) can serve different functions depending on the chosen functional code of their corresponding parameter. In tables 3.B, 3.C and 3.D the functions DI, DO and AIN are described in details:

Table 3.B Digital input functions

<table>
<tr><th>Function</th><th>Control modes</th><th>Func code INx</th><th>Explanation</th><th>MODBUS Address Bit HEX</th></tr>
<tr><td>SON</td><td>Pt,Pr,S,T</td><td>0n01</td><td>Function “Servo ON – permission to operate”. Activating SON sets the servo drive in regime permission to operate, and clears the existing alarms.</td><td>0398.0</td></tr>
<tr><td>ARST</td><td>Pt,Pr,S,T</td><td>0n02</td><td>Function „Alarm reset”. Activating ARST leads to clearing of all existing alarms.</td><td>0398.1</td></tr>
<tr><td>DBLK</td><td>Pt,Pr,S,T</td><td>0n03</td><td>Function “Deblock”. Enable moving (motor rotating), when “CWL” and “CCWL” are active.</td><td>0398.2</td></tr>
<tr><td>CCLR</td><td>Pt</td><td>0n04</td><td>Function „Position register clearing”.</td><td>0398.3</td></tr>
<tr><td>ZCLM</td><td>S,T</td><td>0n05</td><td>Function „Zero speed zone”. Function is activated only by analog reference. When input signal is active and analog speed reference is lower than the value in P1-14 (ZCL), it is performed zero speed reference („holding” the motor in current position).
Parameter P1-06 (ADT) must be set to avoid a hit in the mechanics by entering and exiting regime “Zero speed zone”.</td><td>0398.4</td></tr>
<tr><td>CMDINV</td><td>S,T</td><td>0n06</td><td>Function “Command inverting”. Activating CMDINV leads to inverting of input command (reverse of motor direction of rotation).</td><td>0398.5</td></tr>
<tr><td>INHP</td><td>Pt</td><td>0n07</td><td>Function “ Position command prohibition” in regime Pt. If INHP is activated, the position command is not valid.</td><td>0398.6</td></tr>
<tr><td>STEP</td><td>Pr</td><td>0n08</td><td>Function “ Step performance”. In position control mode Pr, transition 0->1 of input signal leads to repeated performance of the previous position command. Function STEP allows operation with analog input as position command.</td><td>0398.7</td></tr>
<tr><td>OHM</td><td>Pt,Pr,S,T</td><td>0n09</td><td>Motor over heat</td><td>0398.8</td></tr>
<tr><td>GNM</td><td>Pt</td><td>0n10</td><td>Function “Electronic gear”. In position control mode Pt, the reference is scaled.
By active input, the scale is set from P1-08 (B1M).
If input is off, the scale is set from P1-09(B2M).</td><td>0398.9</td></tr>
<tr><td>SC0
SC1
SC2</td><td>Pt,Pr,S,T</td><td>0n11
0n12
0n13</td><td>Selection of speed command source:
<table>
<tr><th>SC2</th><th>SC1</th><th>SC0</th><th>Parameter</th></tr>
<tr><td>0</td><td>0</td><td>0</td><td>S mode: analog input or P2-27
Sz mode: 0</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>P2-20 (SPD1)</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>P2-21 (SPD2)</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td>P2-22 (SPD3)</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td>P2-23 (SPD4)</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td>P2-24 (SPD5)</td></tr>
<tr><td>1</td><td>1</td><td>0</td><td>P2-25 (SPD6)</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>P2-26 (SPD7)</td></tr>
</table></td><td>0398.10
0398.11
0398.12</td></tr>
<tr><td>EMGS</td><td>Pt,Pr,S,T</td><td>0n14</td><td>Function „Emergency stop”. It is recommended to use the input signal as normally opened contact. By active input, the speed command is not valid, the motor stops.</td><td>0398.13</td></tr>
<tr><td>TC0
TC1
TC2</td><td>Pt,Pr,S,T</td><td>0n15
0n16
0n17</td><td>Selection of torque command source:
<table>
<tr><th>TC2</th><th>TC1</th><th>TC0</th><th>Parameter</th></tr>
<tr><td>0</td><td>0</td><td>0</td><td>T mode: analog input
Tz mode: 0</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>P2-28 (TRQ1)</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>P2-29 (TRQ2)</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td>P2-30 (TRQ3)</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td>P2-31 (TRQ4)</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td>P2-32 (TRQ5)</td></tr>
<tr><td>1</td><td>1</td><td>0</td><td>P2-33 (TRQ6)</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>P2-34 (TRQ7)</td></tr>
</table></td><td>0399.0
0399.1
0399.2</td></tr>
</table>

<table>
<tr><td>SW-Pt</td><td>Pt,Pr,S,T</td><td>0n18</td><td>Function „Switching to Pt mode”
By active input is realizing a switch from basic mode of operation set in P1-01 (CTM)to operation mode with position control Pt..
By switched-off input is realizing a switch from operation mode with position control Pt to basic mode of operation, set in P1-01 (CTM).
The function is active only during servo drive operation (SON is active).</td><td>0399.3</td></tr>
<tr><td>SW-Pr</td><td>Pt,Pr,S,T</td><td>0n19</td><td>Function „Switching to Pr mode”
By active input is realizing a switch from basic mode of operation set in P1-01 (CTM)to operation mode with position control Pr.
By switched-off input is realizing a switch from operation mode with position control Pr to basic mode of operation, set in P1-01 (CTM).
The function is active only during servo drive operation (SON is active).</td><td>0399.4</td></tr>
<tr><td>SW-S</td><td>Pt,Pr,S,T</td><td>0n20</td><td>Function „Switching to S mode”
By active input is realizing a switch from basic mode of operation set in P1-01 (CTM)to operation mode with speed control S.
By switched-off input is realizing a switch from operation mode with speed control S to basic mode of operation, set in P1-01 (CTM).
The function is active only during servo drive operation (SON is active).</td><td>0399.5</td></tr>
<tr><td>CWL</td><td>Pt,Pr,S,T</td><td>0n21</td><td>Function “Clockwise rotation forbidden”.By active input, the positive speed rotation command is not valid. The application is like limit switch.It is recommended to use the input signal as normally closed contact.
In mode “Zero return” function “CWL” is identical with “DEC”</td><td>0399.6</td></tr>
<tr><td>CCWL</td><td>Pt,Pr,S,T</td><td>0n22</td><td>CCWL е идентична с DEC(гърбица).
Function “Counter clockwise rotation forbidden”.
By active input, the negative speed rotation command is not valid. The application is like limit switch.
It is recommended to use the input signal as normally closed contact.
In “Zero return” function CCWL is identical with DEC</td><td>0399.7</td></tr>
<tr><td>PC0
PC1
PC2</td><td>Pr</td><td>0n23
0n24
0n25</td><td>Choosing source of position command:
<table>
<tr><th>PC2</th><th>PC1</th><th>PC0</th><th>Parameter</th></tr>
<tr><td>0</td><td>0</td><td>0</td><td>P2-43</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>P2-36</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>P2-37</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td>P2-38</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td>P2-39</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td>P2-40</td></tr>
<tr><td>1</td><td>1</td><td>0</td><td>P2-41</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>P2-42</td></tr>
</table></td><td>0399.8
0399.9
0399.10</td></tr>
<tr><td>DEC</td><td>Pt,Pr,S,T</td><td>0n26</td><td>Function “Deceleration switch for ZRN mode”. It is valid after activating of ZRST. By initially switched-off input the speed command is from P1-13 (HZS) – first stage of functional mode “Zero return”. By transition of input signal 0->1 is starting the second stage – speed command is from P1-12 (LZS). By transition of input signal 1->0 is starting the third stage of the regime “Zero return” - stop at reference point (Z pulse of encoder).
The reference point position becomes absolute in position control mode Pr.</td><td>0399.11</td></tr>
<tr><td>ZRST</td><td>Pt,Pr,S,T</td><td>0n27</td><td>Function “Start ZRN”. By transition of input signal 0->1 is starting functional mode “Zero return” ZRN.</td><td>0399.12</td></tr>
<tr><td>RFST</td><td>Pt,Pr,S,T</td><td>0n28</td><td>Function “Absolute position”. By transition of input signal 0->1 the current position becomes absolute in position control mode Pr.</td><td>0399.13</td></tr>
</table>

JOG+	Pt,Pr,S	0n32	Function 'Rotation +". By active input, the motor will rotate in positive direction (counter clockwise) with speed command defined from P1-11 (PSPD).	**039A.0**
JOG-	Pt,Pr,S	0n33	Function 'Rotation -". By active input, the motor will rotate in negative direction (clockwise) with speed command defined from P1-11 (PSPD).	**039A.1**
For all input functions		n	**Input signal polarity** **0 - normally closed (contact "b")** **1 - normally opened (contact "a")**	

Table 3.C DO functions of output signals

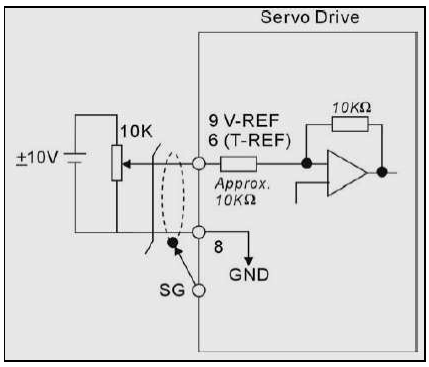
Function	Modes of operation	Multifunctional code DOUTx	Explanations	MODBUS Address Bit HEX
SRDY	Pt,Pr,S,T	0n01	Function "Ready to operate". SRDY is activated when the servo drive is under voltage and hasn't alarms.	**039C.0**
SON	Pt,Pr,S,T	0n02	Function " Permission to operate". SON output is active when the control voltage is applied on the servo drive, there isn't any alarm and SON input is activated.	**039C.1**
ZSPD	Pt,Pr,S,T	0n03	Function "Zero speed". It is activated when the motor speed is equal or lower than the set-up, defined in parameter P2-49 (ZSP)	**039C.2**
TSPD	Pt,Pr,S,T	0n04	Function "Speed arrival". It is activated when the motor speed is equal or higher than the set-up, defined in parameter P2-50 (TSP).	**039C.3**
TPOS	Pt,Pr	0n05	Function "In position". In position mode of operation Pt or Pr, TPOS will be activated, when the difference between the command and real position is equal or less than the set-up in parameter P1-10 (INP).	**039C.4**
TQL	Pt,Pr,S,T	0n06	Function 'Torque limit". TQL is activated when the motor has reached the current limitation, set-up with some of parameters P2-28 ~ P2-35.	**039C.5**
ALRM	Pt,Pr,S,T	0n07	Function "Alarm". ALRM is activated when the servo drive is in alarm condition.	**039C.6**
BRKR	Pt,Pr,S,T	0n08	Function "Break release". It is activated when control voltage is applied on servo drive, there is no alarm condition and SON input is activated.	**039C.7**
OLW	Pt,Pr,S,T	0n09	Function "Overload". OLW will be activated when the motor has reached the overload limit - P3-05 (OVL) and the permitted time is not exceeded.	**039C.8**
WARN	Pt,Pr,S,T	0n10	Function "Warning". WARN is activated when the servo drive has detected not critical error, defined in P3-11 (ARM) as: - Error - Rotation clockwise prohibited; - Error - Rotation counter clockwise prohibited; - Error - Serial communication - Error - Low voltage	**039C.9**
BRKD	Pt,Pr,S,T	0n11	Function „Brake resistor" actuated.	**039C.10**
RPOS	Pt,Pr,S	0n12	Output signal is active when: - Functional mode "Zero return ZRN" is finished. - The absolute position for operation in Pr mode is set -up	**039C.11**
CMP1	Pt,Pr	0n13	Function " Comparison 1". It is activated when the current position of encoder is smaller than the set in parameter P0-19 (COMP1).	**039C.12**
CMP2	Pt,Pr	0n14	Function " Comparison 2". It is activated when the current position of encoder is bigger than the set in parameter P0-20 (COMP2).	**039C.13**
TCUR	Pt,Pr,S,T	0n15	Output "Current reached". TCUR is activated when the current (proportional to the torque) is equal or bigger than the set in parameter P2-51 (TCRR).	**039D.0**
For all output functions		n	**Поляритет на входният сигнал** **0 - нормално затворен (контакт "b")** **1 - нормално отворен (контакт "a")** **Input signal polarity**	

Table 3.D Functions of analog inputs

Function	Modes of operation	Functional code AINx	Explanations	MODBUS Address HEX
DISBL	Pt,Pr,S,T	0000	Corresponding analog input (ANL1or ANL2) is blocked or it is not used.	**336/337**
REF	Pt,Pr,S,T	0001	If AIN1 = 0001, analog signal ANL1 (V-REF/GNDA) is speed reference or speed limitation. If AIN2 = 0001, analog signal ANL2 (V-REF/GNDA) is torque reference or torque limitation.	**336/337**
ASTEP	Pr	0002	If AIN1 = 0002, analog signal on ANL1 (V-REF/GNDA) is position reference, when STEP function is performed. If AIN2 = 0002, ANL2 IS NOT USED.	**336/337**
FBCK	Pt,Pr,S,T	0003	If AIN1 = 0003 – ANL1 IS NOT USED If AIN2 = 0003, analog signal on ANL2 (T-REF/GNDA) is speed feedback from tachogenerator.	**336/337**
DIGX	Pt,Pr,S,T	1xxx	The corresponding analog input is used as input digital function, where xxx is DIN code (see table 3.B). For example if the customer sets this parameter **1101**, than **analog input function is SON (normally opened contact).** Parameters on the input – analog level of the signal (truth or not truth) is set in P2-12 (A1LV) or P2-16 (A2LV).	**336/337**

3.2.3. Wiring diagrams of input/output signals

C1: Analog inputs for Speed/Torque reference



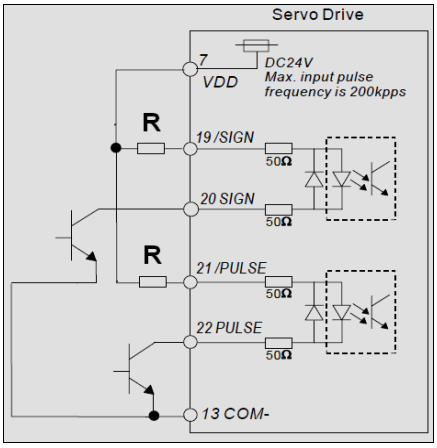
The servo drive has 2 multifunctional analog inputs. The valid range of control analog voltage is from -10VDC to +10VDC. Every input is characterized by 5 parameters:

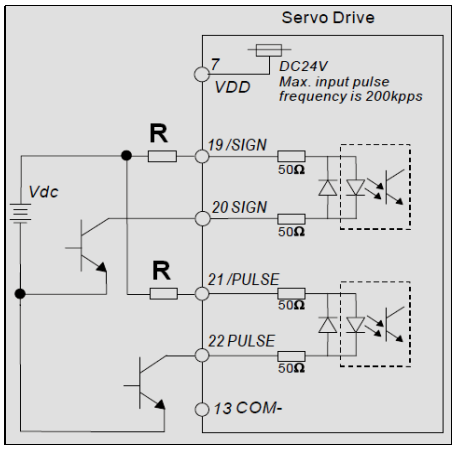
- offset adjustment (A1OF, A2OF)
- scaling coefficient (A1M, A2M)
- truth level (A1LV, A2LV)
- status (ANL1, ANL2)
- functional code (AIN1, AIN2)

Pulse inputs

The servo drive has two differential pulse inputs. In regime of internal position control Pt, the reference can be produced from two output types of controller (PLC): Active output (Line driver) or Open collector. The maximal frequency of the pulse sequences by Line driver connection is 500kpps, and by Open collector is 200kpps.

C2: Pulse input by "Open collector" connection – internal / external power supply

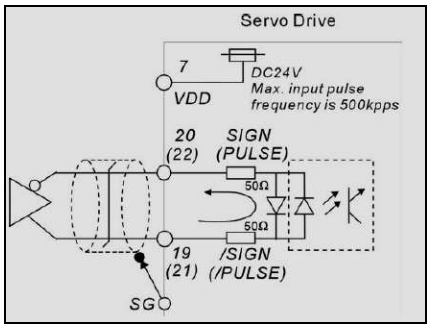




Vdc	Specification
24V	1KΩ
12 V	500Ω

Equation: $\frac{Vdc-2}{100+R} \cong 20mA$

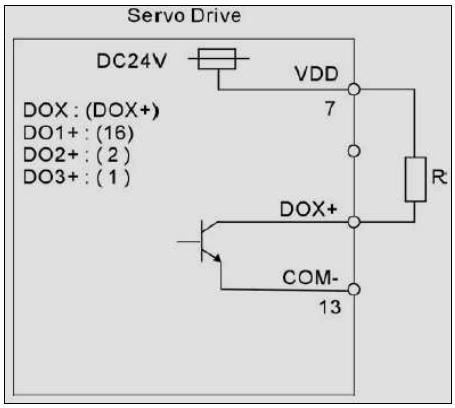
C3: Pulse input by "Active output" connection

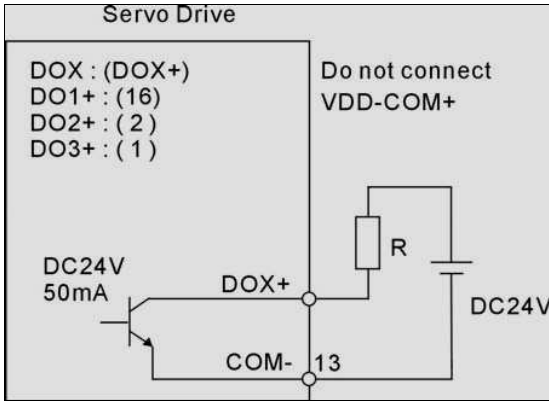


NOTE

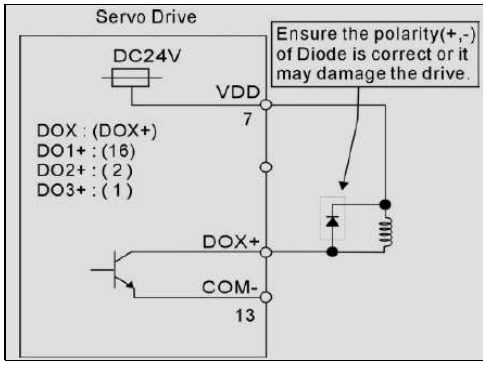
- To protect input circuits, when use open collector output, please, connect in series one current limit resistor 1 to 2 KΩ on 19 (/SIGN) and 21(/PULSE) (see connecting diagram C2).
- To determine the value of current limiting resistor please see the table.

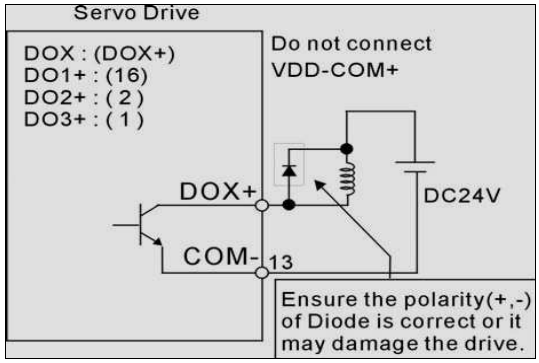
C4: Connection on digital input, by using external/internal supply, active load



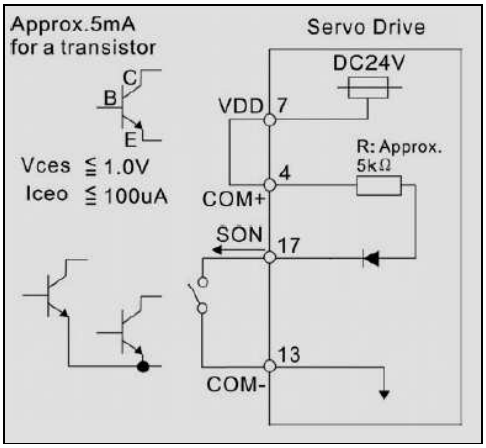


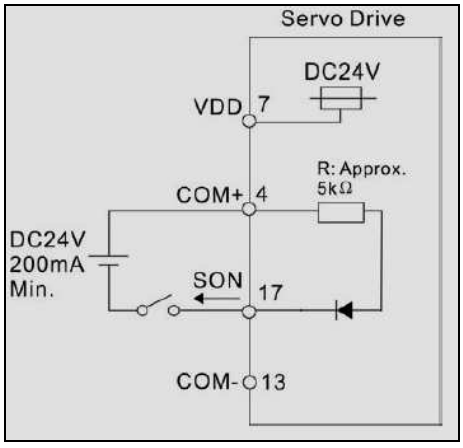
C5: Connection on digital input, by using external/internal supply, inductive load



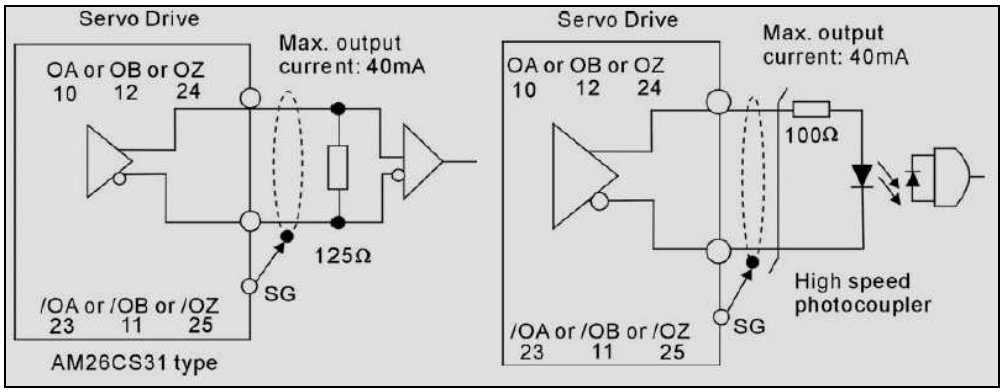


C6: Connection on digital input, by using external/internal supply, (type NPN transistor)





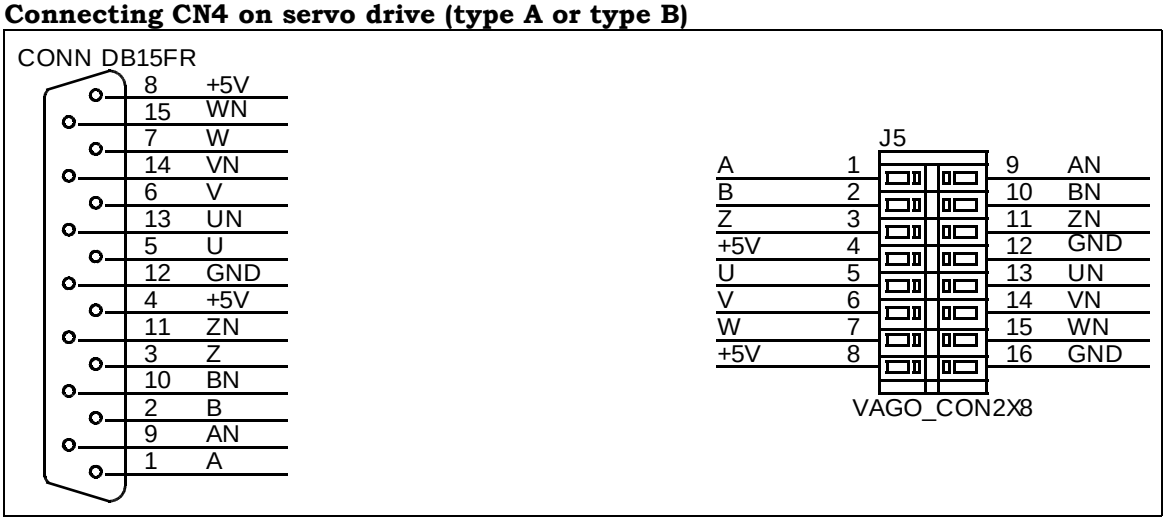
C7: Buffered digital outputs from encoder – active output / optocoupler



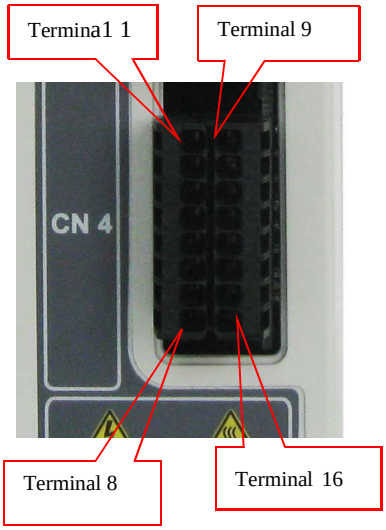
3.3. Connector CN4 – position / speed feedback

Series servo drives ELAS are designed to drive servo motors with position/speed feedback from encoder. The encoders, assembled to the motor, usually have 2500ppr (A and B) and 1 zero pulse per revolution (Z). The pulse sequences are multiplied internally by 4 to increase the control accuracy. To determine rotor position (by brush-less synchronous motors with permanent magnets) are provided differential inputs (U,V,W).

Connecting CN4 on servo drive (type A or type B)



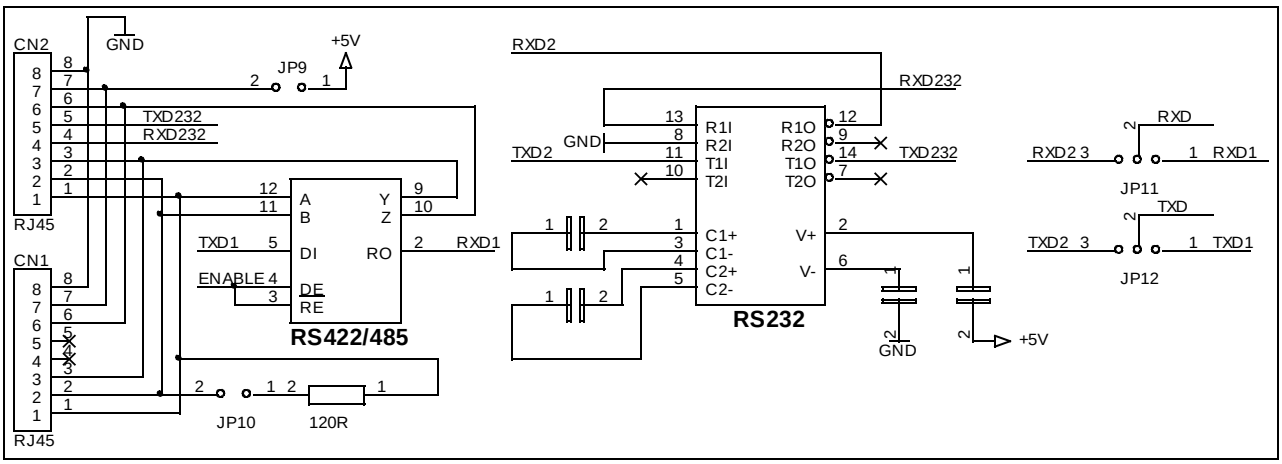
Terminal	Signal	Explanation
1	A	Encoder A pulse input
2	B	Encoder B pulse input
3	Z	Encoder Z pulse input
9	AN	Encoder AN pulse input
10	BN	Encoder BN pulse input
11	ZN	Encoder ZN pulse input
5	U	Encoder U pulse input
6	V	Encoder V pulse input
7	W	Encoder W pulse input
13	UN	Encoder UN pulse input
14	VN	Encoder VN pulse input
15	WN	Encoder WN pulse input
4 , 8	+5V	+5V encoder supply
12 , 16	GND	0V - ground of supply

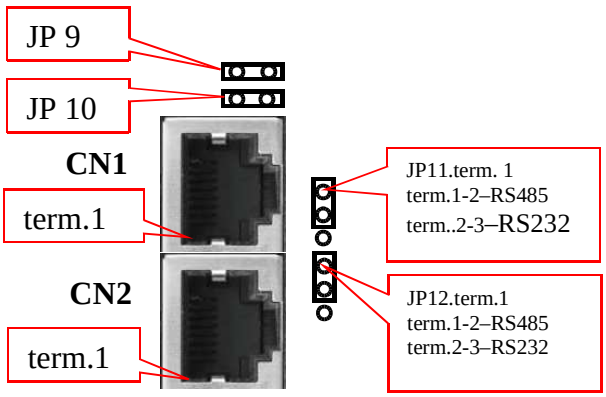


3.4. Connectors CN1 and CN2 for serial interface

Series servo drives ELAS have 2 types hardware protocols for serial communication RS-232 (only on CN2) and RS485 (CN1 and CN2). The customer can control the servo drive with the help of PC software, delivered by "Electroinvent" Ltd or by controller supporting standard MODBUS serial interface. The maximum length of the cable for RS-232 is 15m. The use of RS-485 allows bigger distance of transmitting and allows simultaneous connection with more drives.

Electrical drawing of serial interface





To PC

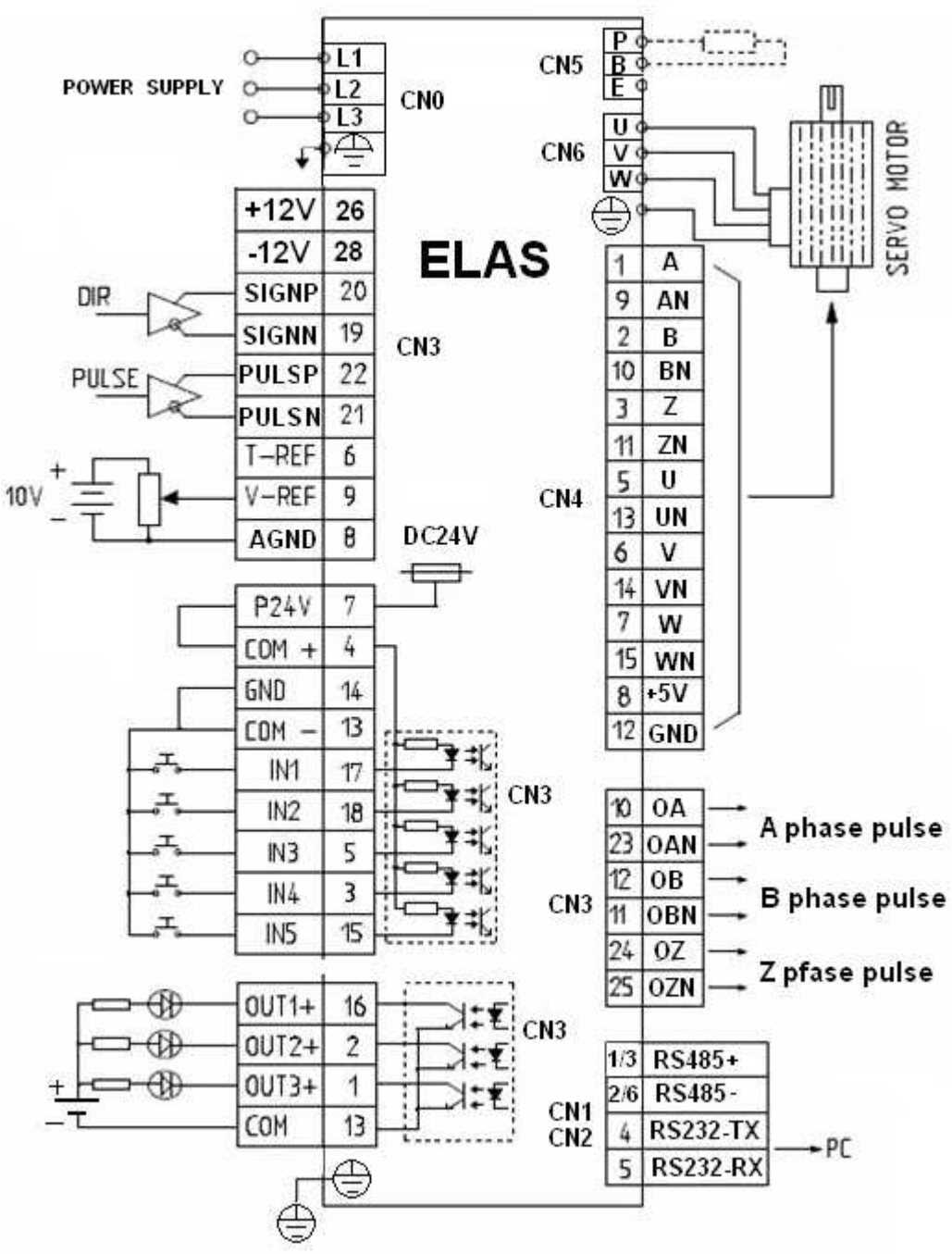
Wiring by connection type RS232

Connector RJ45 CN2 (only)	RS232 / PC	DB9M MALE CONNECTOR CABLE
4	TX	3
5	RX	2
8	GND	5

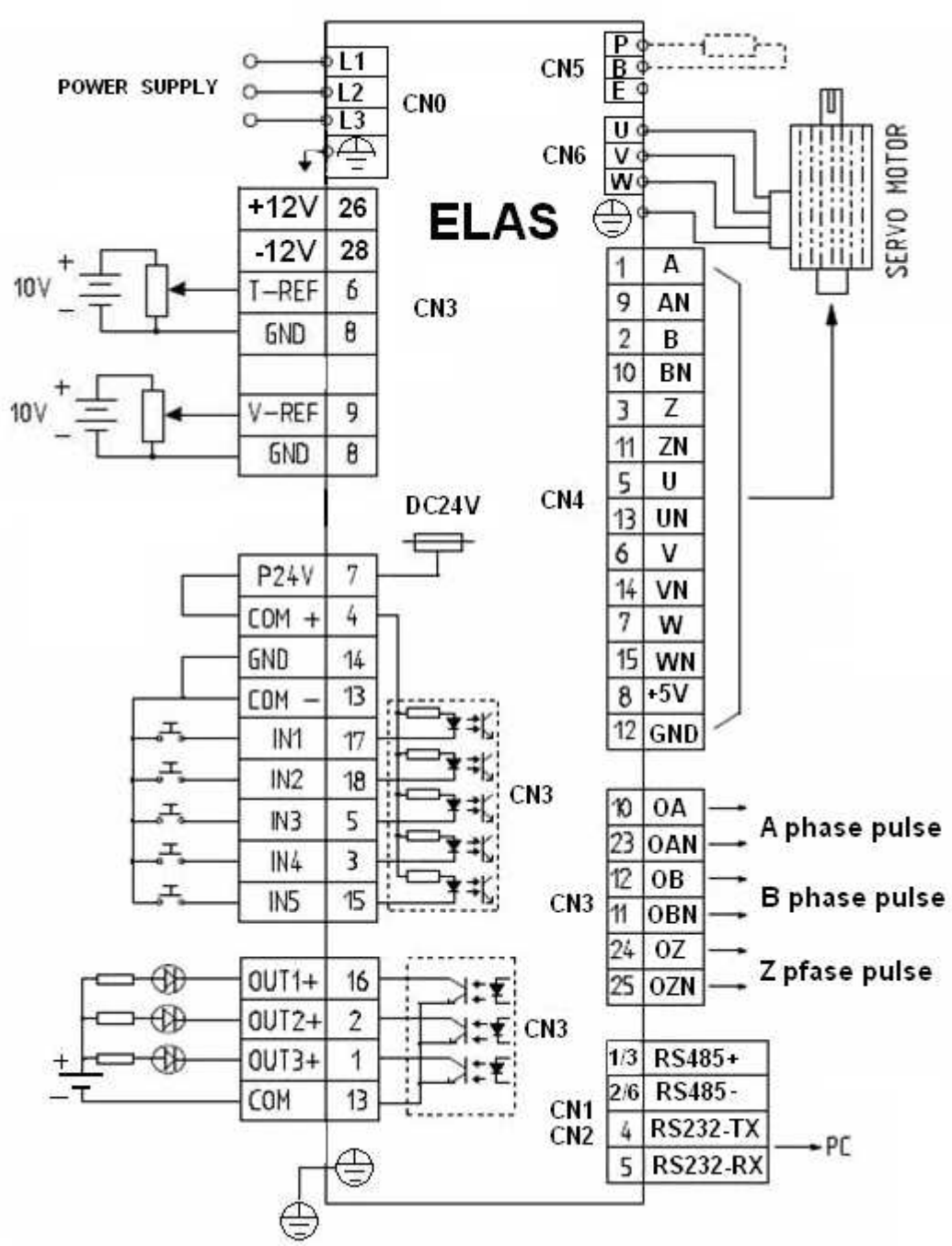
Wiring by connection type RS485

Connector RJ45 CN1 or CN2	RS485	Explanation
1	RX+	Non inverted input
2	RX-	Inverted input
3	TX+	Non inverted output
6	TX-	Inverted output
8	GND	Ground

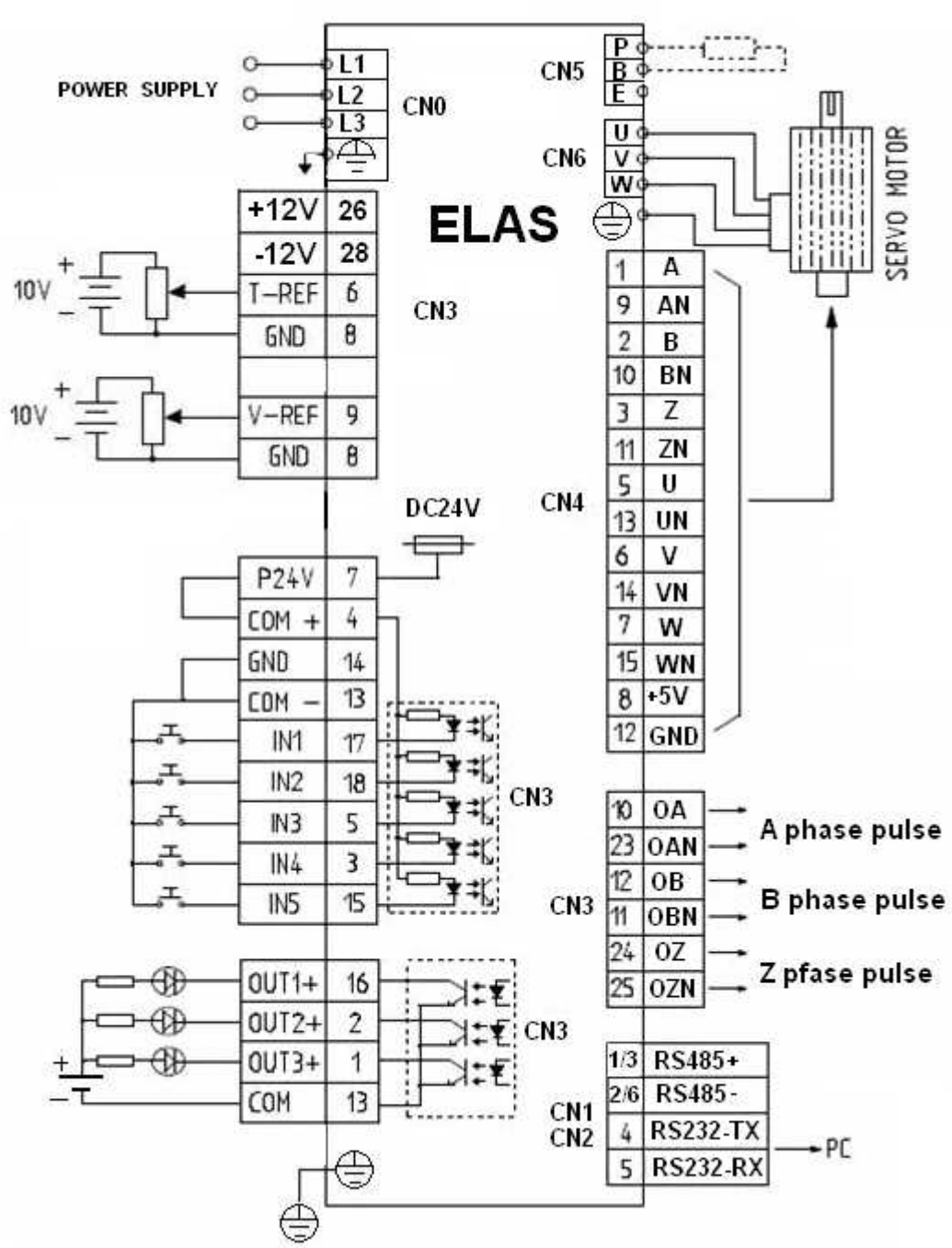
3.5. Examples about standard connection of input/output interface
3.5.1. Position control mode



3.5.2. Speed control mode



3.5.3. Torque control mode

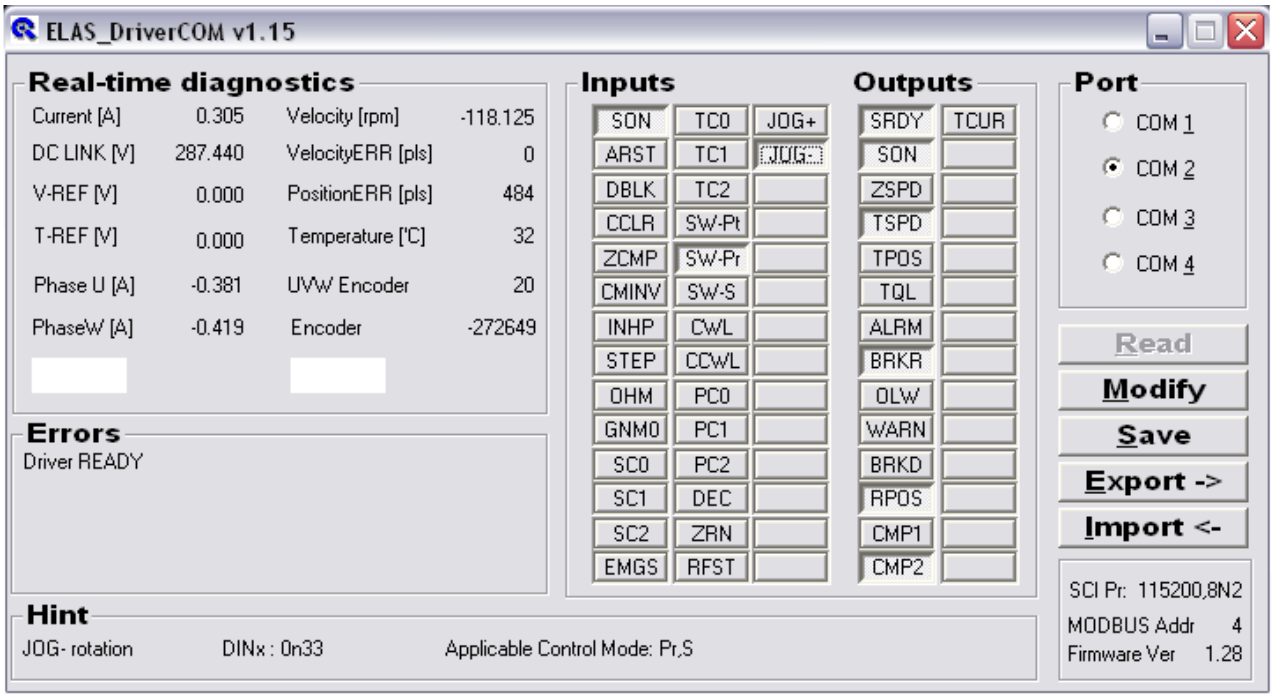


This chapter illustrates connection of servo drive ELAS to personal computer (PC) and explains the basic instructions for adjustment using DriverCom software. For that purpose it is necessary the customer to be familiar with the following 3 stages:

1. Connection of servo drive to PC
2. Adjustment of parameters
3. Storage of parameters

Connection to the servo drive

1. Install DriverCom software on your PC or laptop.
2. Connect RS-232 communication port of PC to serial interface of servo drive CN2.
3. Connect the feedback from the motor (encoder) to corresponding connector for feedback CN4.
4. Connect power cables between motor servo drive.
5. Connect power supply to the servo drive.
6. Click twice on DriverCom.exe to start the configuration software.
7. In field ***Port*** choose the corresponding communication port for connection with servo drive, choose button ***Read.***



The software package DriverCom is a dialog application, consisting of three dialog windows – one main and two additional. After starting of the executing file - DriverCom.exe the main window of the application opens. The access to the additional windows is realizing by buttons ***Modify*** *and* ***Save Parameters.***

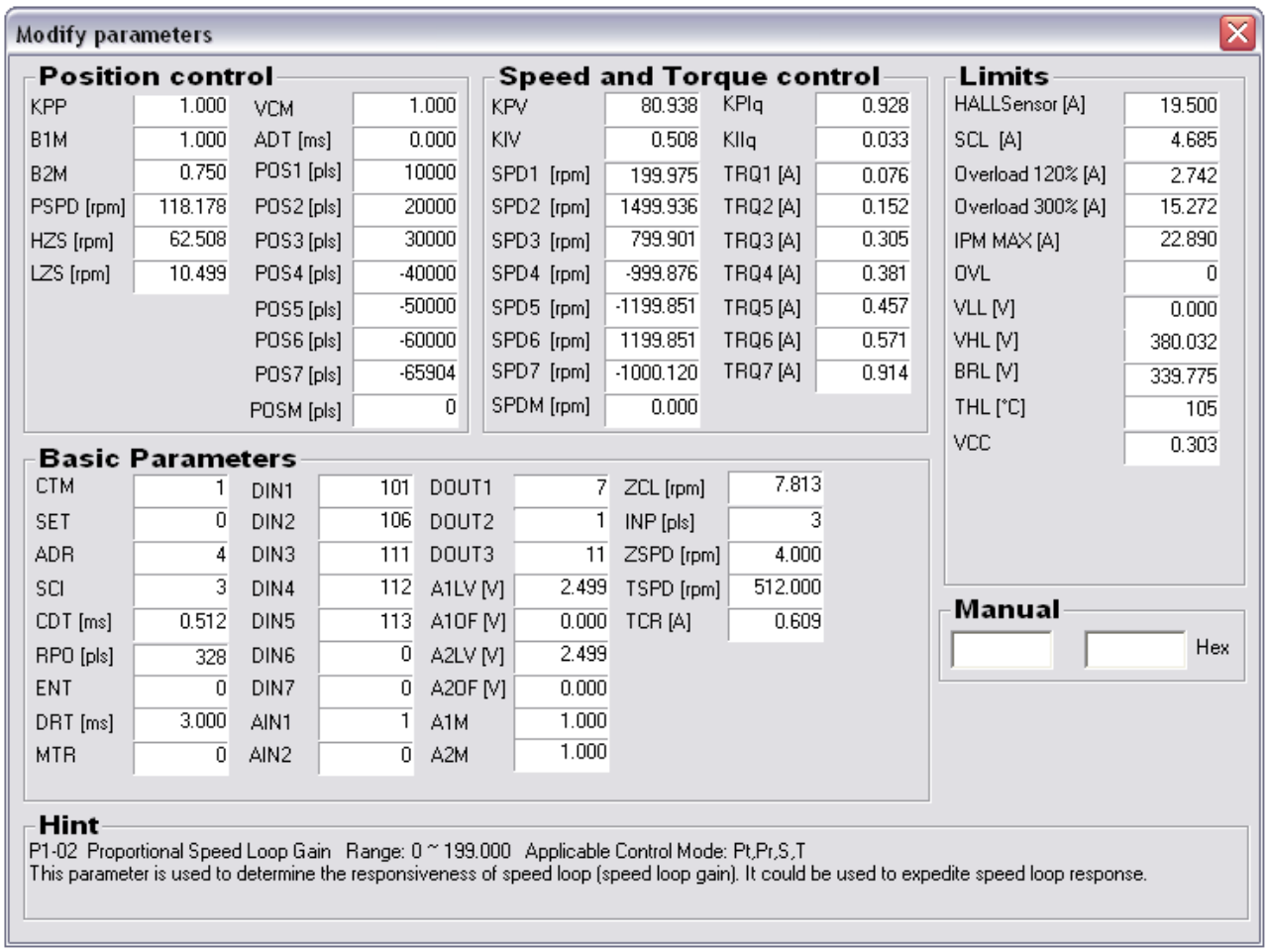
The main dialog window offers the following fields:

1. ***Real-time diagnostics*** for visualization of the basic parameters. In this field the user can observe in real time the current (proportional to the torque), voltage, analog inputs, the temperature of the heat sink, position of the encoder, the speed of the motor, position and speed deviation, etc.
2. ***Errors*** for visualization of alarm conditions. In this field are written the appeared during operation alarms.
3. ***Inputs*** for direct activation of all input functions. It consists of 3 groups of buttons allowing the user directly to switch-on/switch-off corresponding input functions. Also the buttons visualize the status of corresponding input function, by activating from external input signal on connector CN3.
4. ***Outputs*** for observing of all output functions. In this field the user diagnoses the status of output functions.

5. ***Hint*** about subsidiary messages. The field gives subsidiary and reference data for operation with the configuration software.
6. ***Port*** about the choice of serial port for communication with the servo drive.
7. Button ***Read*** – for reading and visualization of all parameters and diagnostics of operational memory RAM of the servo drive.
8. Button ***Modify*** – for opening of the second dialog window.
9. Button ***Save*** – for opening of the third dialog window, connected with writing parameters into the energy independent Flash from RAM memory.
10. Button ***Export*** – for opening of the dialog window, connected with saving parameters into the RAM memory from file.
11. Button ***Import*** – for opening of the dialog window, connected with reading parameters into file from RAM memory of the Servo drive unit.
12. A field, containing information about software version, MODBUS address and communication protocol of the servo drive.

Parameter adjustment

From the main dialog window, click upon button ***Modify*** to open the second window for configuration software - *Modify Parameters.*



This dialog window offers the following fields about configuration of all parameters for servo drive operation:

1. ***Position control***. This field contains all parameters, connected with position control modes Pt and Pr.
2. ***Speed and Torque control.*** This field contains all parameters, connected with speed control mode "S" and torque control mode "T".
3. ***Limits.*** This field contains parameters, connected with the limitations during servo drive operation.
4. ***Basic Parameters*** – contains the main parameters for the choice of control mode, choice of input and output functions, communication parameters, etc.

5. ***Manual*** – secures access to address-space in the memory, allowing manual input and reading the addresses of the servo drive.
6. ***Hint*** - for subsidiary messages. The field gives subsidiary and reference data about operation with the software for configuration, limitations of in-putting values and explanations.

To perform changes of the values of certain parameter, it is necessary the user to:

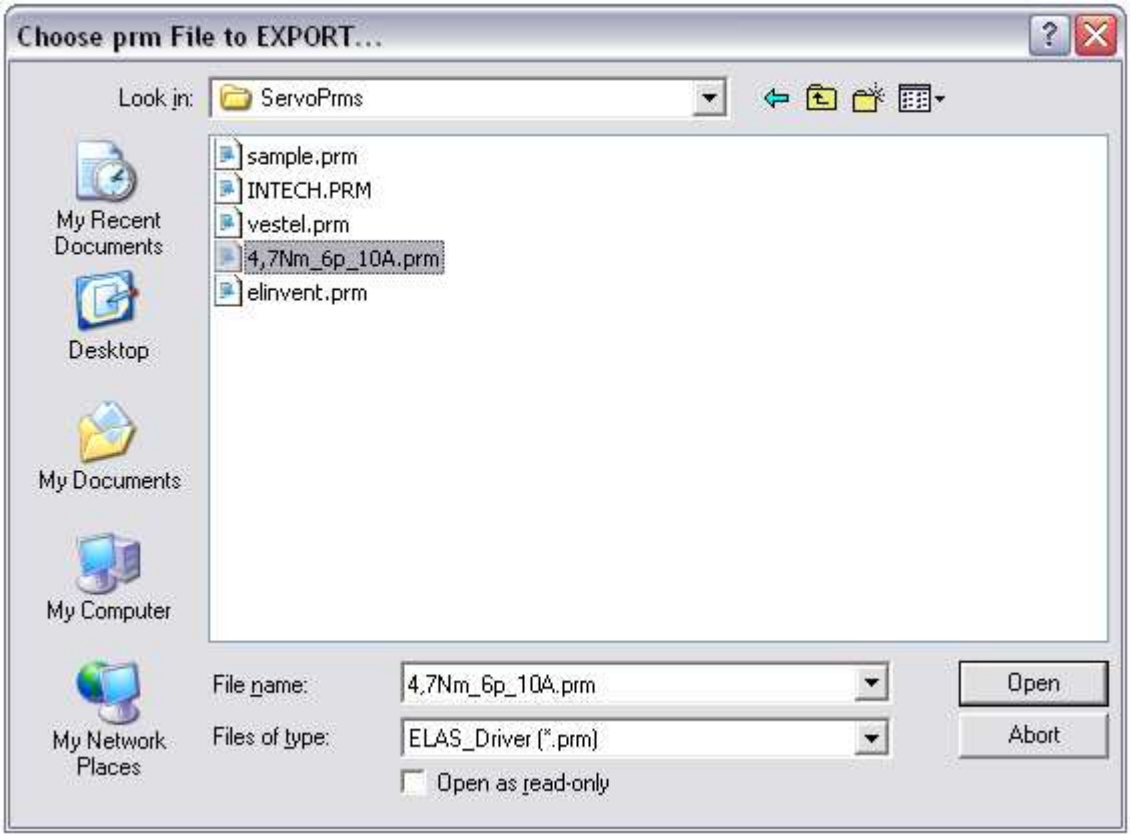
- Place the mouse cursor in the field of the corresponding parameter;
- Input the desired value, taking into consideration the minimal and maximal values of corresponding parameter;
- Press Enter for adoption of the new value.

По горе описаните инструкции се променят стойностите на параметрите само в оперативната памет RAM на серво задвижването и няма да се запишат в енерго независимата памет Flash. Повечето параметри, като например CTM (режим на работа), DINx (входна функция) и др. са ефективни след като се запишат във Flash паметта. Затова е нужно да бъдат съхранени по следният начин :
With above described instructions are changing the values of parameters only in operational RAM memory of the servo drive and they can not be written into the energy independent Flash memory. Most parameters, for example CTM (control mode), DINx (input function), etc are effective after writing into the Flash memory. That's why it is necessary to be saved like follows:
Parameters saving

NOTE

Preservation of the parameters is done in condition that servo drive hasn't permission for operation. Make sure, that the input function SON is not active.

From main dialog window click upon button ***Export*** to open window *Choose prm to EXPORT…*

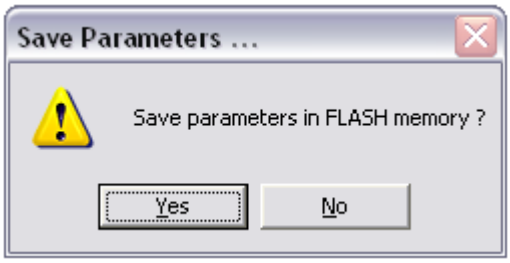


This window has 2 buttons:
1. ***Open*** - for parameters transfer from file with extension ***XXX.prm*** into operational RAM memory. After pushing the button, a dialog window for access near the needed file with parameters is opening. The user chooses the file, which to be loaded into operational memory. The parameters are extracted from the file.
2. ***Abort –*** for canceling the operation

From main dialog window click upon button ***Import*** to open window *Create prm File to IMPORT…*

This window has 2 buttons:
1. ***Open*** - for creation (archiving) of file with parameters. After pushing the button, a dialog window opens for parameter file creation. The user chooses the name of the file and directory, in which extension ***XXX.prm*** to be created. The parameters are extracted from operational memory.
2. ***Abort –*** for canceling the operation

From main dialog window click upon button ***Save*** to open window *Save Parameters…*



This window has 2 buttons:
1. ***Yes*** – for saving the changed parameters from operational RAM memory to energy independent Flash memory. After pushing the button, all parameters are stored, the servo drive is resetting and it is ready to operate.
2. ***No*** - for canceling the operation

Chapter 5 Initial run and tuning

5.1. Inspection without load

- To avoid accidents, the initial run of the servo drive must be performed without load (separate the motor from clutches, belts, gears).
- After the initial run of the servo drive without load is normal, you can pass to operation with connected load.

Follow the instructions, to avoid unnecessary risks:

Activity	Contents
Inspection before operation	• Check the servo drive and servo motor for eventual damages • Check connection between earthing bolt on the servo drive and earthing installation of the electrical cabinet or of the building.  • To avoid electrical shock, check the connection between earthing terminal of the servo drive ⏚ and earthing terminal ⏚ of el. motor; • After switch-off the power supply wait 5 minutes to discharge the capacitors, before making whatever connections;  • Check if all terminals are well insulated; • Never place easy flammable substances upon servo drive or near braking resistor; • ***Attention:*** Servo drive and motor emit heat;  It is necessary to secure enough distance between servo drive and other parts in the cabinet for heat dissipation; • If electromagnetic break is used, check about its correct connection; • Check if the external applied voltage corresponds to the servo drive type.

5.2. Applying power to servo drive

Before applying power to the servo drive check about:

1. Wiring between servo drive and electrical motor as follows:

- Check if connection of power supply to the servo drive L1, L2, L3 and ⏚ on CN0, as well as protective earthing ⏚**,** are performed in accordance with the respective wiring diagram and cross sections of the cables are according to corresponding table (shown in chapter 3 of this manual).
- Check if connection of el. motor terminals U, V, W on CN6, as well as protective earthing ⏚ **,** are performed in accordance with the respective wiring diagram and cross sections of the cables are according to corresponding table (shown in chapter 3 of this manual).
- Check about correct connection of encoder cable to connector CN4.

If the user wants to execute only function JOG+/JOG- (rotation), It is not necessary to perform connecting of connector CN3. For more information about connection of connector CN3, please, refer to chapter 3.4.

NOTE

Never connect input power supply voltage (L1,L2,L3 and ⏚) to output terminals (U, V, W and ⏚). it will damage the servo drive.

2. Wiring of supply circuit

Connect power supply to servo drive. Wiring diagrams of three-phase input and one-phase input are shown in chapter 3.1.3.

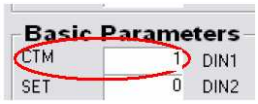
3. Switch on of power supply

The servo drive is supplied from terminals L1,L2,L3,⏚ on connector CN0. When servo drive is switched on initially, it is initializing. After initializing, if the green LED "ON" is blinking, that means, the servo drive is ready for operation. If the red LED "AL" is lighting, refer to parameter P0-01 (servo drive error code) or to field Errors of software package DriverCom to clarify the error message. To eliminate it, please, refer to chapter 10 (Troubleshooting).

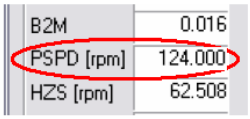
5.3. Trial run without load with JOG function (rotation)

The trial run without load with JOG function is very convenient to test the correct wiring of the servo drive and the motor. It is not necessary additional wiring of input/output signals on CN3. The user has to connect only the PC (DriverCom software) to the servo drive. For safety, it is recommended, to be set lower value of parameter for JOG speed (for example P1-11 (PSPD) = 124.00 rpm).
Follow the following steps to make the trial run:

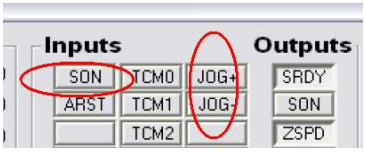
Step 1: Start the software DriverCom and push button *Read*. Check if the servo drive is in ready condition and there are no errors.
Step 2: Set P1-00 CTM (Control Mode) to 1 – Speed control mode (S mode)



Step 3: Set P1-11 PSPD (Position, JOG Speed) on 124.00 rpm.

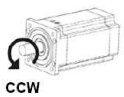


Step 4: Push "Save Parameters" to preserve the new parameters in energy independent Flash memory. Then the servo drive is resetting automatically and it is ready to operate.
Step 5: Push SON button to permit operation. Check if there is no error and if the servo drive is in normal condition.

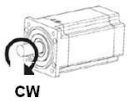


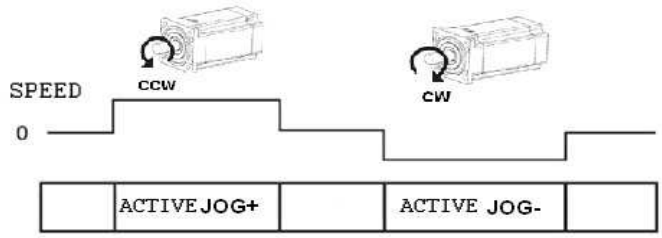
Step 6: Activate JOG+ button and servo motor will start to rotate in positive direction (counter clock wise CCW). After deactivating of JOG+ button, the motor will stop.
Step 7: Activate JOG- button and servo motor will start to rotate in negative direction (clock wise direction CW). After deactivating of JOG- button, the motor will stop.
Step 8: When activate both buttons JOG+ и JOG- the motor will stop also.

Definition of CW and CCW directions:
CCW (counter clock wise):
when look the motor from shaft side
and it is rotating in positive (reverse) direction.



CW (clock wise):
when look the motor from shafts side
and it is rotating in negative (right) direction.





NOTE

If motor is not rotating, please, check connection of output terminals - U,V,W and encoder.
If motor is rotating not correctly, check about correct order of the phases U,V, W of the connected to the motor cables.
The function JOG is not valid, when some of the functions are active: EMGS (emergency button), CWL (rotation in negative direction forbidden) or CCWL (rotation in positive direction forbidden).

5.4. Trial run without load by functions SC0-SC2 (speed reference from parameters)

Before trial run by speed, fix and secure the motor from eventual risk to jump by starting or by change of its speed.
Step 1: Set values of parameter P1-00 (CTM) = 11 to choose speed control mode (Sz).
Step 2: In speed control mode, the necessary input functions are listed as follows:

Parameter of input function	Setting the parameter	Symbol	Function description	Terminal on connector CN3
DIN1	P2-01 = 101	SON	Servo ON	DI1 = 17
DIN2	P2-02 = 106	CMDINV	Inverting of reference	DI2 = 18
DIN3	P2-03 = 111	SC0	Choice of speed reference 1	DI3 = 5
DIN4	P2-04 = 112	SC1	Choice of speed reference 2	DI4 = 3
DIN5	P2-05 = 113	SC2	Choice of speed reference 4	DI5 = 14

Set values of parameters P2-01 to P2-05 according to above table. Digital input functions of series servo drives ELAS are chosen from the user. (for functionality details see Table 3.B in chapter 3, for wiring details of input signals – point 3.2.3 in chapter 3)
If necessary, change the values by understanding of seven parameters for speed reference (P2-20 to P2-26).

NOTE

The choice of speed mode of operation (Sz) and definition of digital inputs must be performed when permission to operate is switched-off (SON function is not activated). The new mode of operation and input functions will be valid after their saving into the „Flash" (***Save parameters***).

The possible choices of speed reference are given in the Table:

Speed reference	Input function			Control mode P1-00 (CTM)		Control source	Description	Range
	SC2	SC1	SC0					
SPD0	0	0	0	**S** P1-00=1	P2-11=0 (AIN1)	P2 до 27 (SPDM)	Modbus Communication	-5000 to 5000 rpm
					P2-11=1 (AIN1)	Analog signal (ANL1)	Voltage between V-REF-GND	-10V до +10V
				Sz P1-00=11		Internal	Speed reference is 0	0
SPD1	0	0	1	Internal parameters (P2-20 to P2-26) (S and Sz modes)			P2-20	-5000 to 5000 rpm
SPD2	0	1	0				P2-21	
SPD3	0	1	1				P2-22	
SPD4	1	0	0				P2-23	
SPD5	1	0	1				P2-24	
SPD6	1	1	0				P2-25	
SPD7	1	1	1				P2-26	

Explanation:**0**: means OFF (switched-off); **1**: means ON (switched-on).

Step 3:
1. Switch-on DIN1 to permit servo drive operation (activate SON).
2. If DIN3 (SC0), DIN4 (SC1) and DIN5 (SC2) are switched-off, is chosen command SPD0.
3. If DIN3 (SC0) is switched-on and DIN4 (SC1) and DIN5 (SC2) are switched-off, command SPD1 is chosen (for example 100 rpm), then the motor speed at that moment should be 100rpm.
4. If DIN4 (SC1) is switched-on and DIN3 (SC0) and DIN5 (SC2) are switched-off, command SPD2 is chosen (for example 200 rpm), then the motor speed at that moment should be 200rpm.
5. If DIN3 (SC0), DIN4 (SC1) and DIN5 (SC2) are switched-off, command SPD7 is chosen (for example 1000 rpm), then the motor speed at that moment should be 1000rpm.
6. Repeat action (3), (4), (5) freely. Use DIN2 (CMDINV) to operate in reverse.
7. Servo drive stops by switch-off of DIN1 (SON).

5.5. Trial run without load in internal control mode by position Pr

Before position trial run, fix and secure the motor not to jump by starting or by change of the reference.

NOTE

Operation mode with internal position reference Pr can not work without initially set Zero return.

Step 1: Set value of parameter P1-00 (CTM) = 3 to choose the internal position control mode Pr).
Step 2: In internal position control mode Pr, the necessary input functions are listed as follows:

Parameter of internal function	Parameter setting	Symbol	Function description	Terminal on connector CN3
P2-01 (DIN1)	P2-01 = 101	SON	Operation permission	17 (DI1)
P2-02 (DIN2)	P2-02 = 128	RFST	Zero return reference	18 (DI2)
P2-03 (DIN3)	P2-03 = 123	PC0	Choice of Position1 reference	5 (DI3)
P2-04 (DIN4)	P2-04 = 124	PC1	Choice of Position2 reference	3 (DI4)
P2-05 (DIN5)	P2-05 = 125	PC2	Choice of Position4 reference	14 (DI5)

Set values on parameters P2-01 to P2-05 according to the Table above. The digital input functions of series servo drives ELAS are chosen by the customer (for functionality details see Table 3.B in chapter 3, for wiring details of input signals – point 3.2.3. in chapter 3).
If necessary, change the values by understanding of the seven parameters for position reference (P2-36 to P2-42).

NOTE

The choice of Position control mode (Pr) and definition of digital inputs must be performed by switched-off operation permission (SON function is not activated). The new operation mode and input functions will be valid after their saving in the „Flash" (***Save parameters***).

The possible choices of speed reference are given in the Table:

Position reference	Speed reference by positioning	Input function			Reference source	Description
		PC2	PC1	PC0		
POS0	PSPD (P1-11)	0	0	0	MODBUS	P2-43 Address 0384H(32bit)
POS1	SPD1 (P2-20)	0	0	1	Internal parameter	P2-36
POS2	SPD2 (P2-21)	0	1	0		P2-37
POS3	SPD3 (P2-22)	0	1	1		P2-38
POS4	SPD4 (P2-23)	1	0	0		P2-39
POS5	SPD5 (P2-24)	1	0	1		P2-40
POS6	SPD6 (P2-25)	1	1	0		P2-41
POS7	SPD7 (P2-26)	1	1	1		P2-42

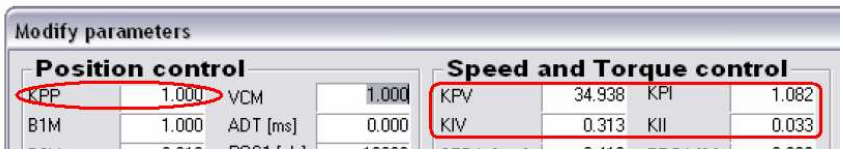
Explanation:
0: means switched-off;
1: means switched-on.
Step 3:
1. Switch-on DIN1 to permit servo drive operation (activate SON).
2. Switch-on DIN2 to set zero return. The current position of the encoder is accepted as zero return point and next references are executed like absolute to the zero return point.

3. If DIN3 (PC0), DIN4 (PC1) and DIN5 (PC2) are switched-off, the command POS0 is chosen-position reference is set by MODBUS (P2-43 POSM).
4. If DIN3 (PC0) is switched-on, DIN4 (PC1) and DIN5 (PC2)are switched-off, a position command POS1 is chosen (for example 10000 pulses/revolution). The motor has to travel toward the zero return 10000 pulses, which is 1 revolution (if encoder has 2500 ppr) with moving speed preset in (P2-20).
5. If DIN4 (PC1) is switched-on, DIN3(PC0) and DIN5 (PC2) are switched-off, a position command POS2 is chosen (for example 20000 pulses/revolution). The motor has to travel toward the zero return 20000 pulses, which is 2 revolutions with moving speed preset in SPD2 (P2-21).
6. If DIN3 (PC0), DIN4 (PC1) and DIN5 (PC2) are switched-on, command POS7 is chosen (for example 70000 pulses), the motor must move toward the zero return 70000 pulses, which is 7 revolutions with moving speed preset in SPD2 (P2-26).
7. Repeat actions in (3), (4), (5) freely.
8. Servo drive stop is achieved by switching-off DIN1 (SON**).**

5.6. Manual gain adjustment

AC servo drives ELAS use cascade circuit to control the servo motor. Internal current contour consisting of PI (proportional-integral) current regulator, embraced from PI speed regulator and outer P (proportional) position regulator. Adjustment of position gain, speed gain and current gain depend on the requirements to the rigidness of the machine control and on the application conditions. If the gains are adjusted correctly, a high performance is achieved, which is very important to make positioning with high speed in applications with high precision mechanical systems.

The increased speed of operation can easily bring to mechanical resonance in the system. When a new machine system is adjusted, the principle adjustment is to increase the gains slowly until the resonance is reached, and then the adjusted value of the gain to be decreased. The corresponding parameters and adjustment methods are described below:



- **Parameter P1-01 (KPP) – Gain adjustment of position regulator**

This parameter is a proportional component of position regulator. It is used for gain reference in position contour. When the adjusted value of **KPP** is bigger, the position contour reaction is faster, the position error is smaller and the responding time is smaller. When the position contour gain is exceeding too much, the mechanical system can be excited during positioning.
When a new mechanical system is adjusted, the gain value **KPP** is increased gradually by hopping input signal, until get to exciting (resonance), after this the value is decreased.

- **Parameter P1-02 (KPV) – Gain adjustment of speed regulator**

This parameter represents a proportional component of speed regulator. It is used for gain reference in speed loop. When the adjusted value of **KPV** is bigger, the speed feedback contour reaction is faster, the speed error is smaller and the responding time is smaller.

When the adjusted value is too high, this can cause excitation and noise (resonance in the mechanical system).

If the reaction of position contour is faster than of the speed contour, the mechanical system is possible to generate vibrations and noise, or even to excitation during positioning.

- **Parameter P1-03 (KIV) - Gain of integral part of speed regulator**

This parameter represents the integral part (reciprocal of integral time constant) of speed regulator. Its function is to null the static error on the regulators input. With increasing the value of KIV the deviation from the speed reference decreases.

When the adjusted value is too high, this can cause excitation and noise (resonance in the mechanical system).

When an unknown machine system is adjusted, the gains **KPV** and **KIV** gradually increase by uneven input signal, until get to exciting (resonance), after this the value is decreased.

- **Parameter P1-04 (KPI) – Gain adjustment of current regulator**

This parameter represents a proportional part of current regulator.
This parameter is used for gain reference of current contour.
The gains of current regulator are factory set, depending on the used el. motor and in more cases it is not necessary to adjust them additionally.
When the value of **KPI** is higher, reaction of current feedback contour is faster, the error on the input is smaller and responding time is smaller.

When the adjusted value is too high, it can bring to excitation (resonance in mechanical system).

When the reaction of speed contour is faster than in the current contour, the mechanical system can generate vibration or noise, or even to excitation during positioning.

- **Parameter P1-05 (KII) - Gain of integral part of current regulator**

This parameter represents the integral part (reciprocal of integral time constant) of current regulator. Its function is to null the static error on the regulators input. The gains of current regulator are factory set, depending on the used el. motor and in more cases it is not necessary to adjust them additionally.

With increasing the value of KII, the deviation of current reference decreases.

When the adjusted value is too high, it can cause excitation and noise (resonance in mechanical system).

6.1 Control modes

AC servo drives series ELAS are designed to control position, speed and torque of the servo motors (brushless synchronous motors with permanent magnets). Depending on the control reference, can be possible to be programmed and executed six single and three dual control modes. Control modes description is shown in the table below:

Operation mode		Code	Description
Single modes	External position control mode	**Pt** P1-00 (CTM) = 0	The servo drive is configured in this mode when position/speed reference are 2 pulse sequences (Step/Direction) sent from external controller (PLC). The frequency of the first pulse sequence defines the speed reference, and number of pulse edges define position reference. The logical level of second pulse sequence defines the direction of rotation.
	Internal position control mode	**Pr** P1-00 (CTM) = 3	The servo drive is configured in this mode when position is referenced: ➢ by Modbus serial interface (COM port). ➢ by digital inputs (DI). (internally by parameters can be set till seven positions).
	Speed control mode	**S** P1-00(CTM) = 1	The servo drive is configured in this mode when speed is referenced: ➢ by Modbus serial interface (COM port). ➢ by digital inputs (DI). (internally by parameters can be set till seven speed references). ➢ by analog input (V-REF / GNDA). -10 VDC to +10 VDC.
		Sz P1-00 (CTM) = 11	The servo drive is configured in this mode when speed is referenced: ➢ by digital inputs (DI). (internally by parameters can be set till seven speed references).
	Torque control mode	**T** P1-00 (CTM) = 2	The servo drive is configured in this mode when torque is referenced: ➢ by digital inputs (DI). (internally by parameters can be set till seven torque references). ➢ by analog input (T-REF / GNDA). -10 VDC to +10 VDC.
		Tz P1-00 (CTM) =12	The servo drive is configured in this mode when torque is referenced: ➢ (internally by parameters can be set till seven torque references).
	Adjustment of abs. rotor position	**ARP** P1-00 (CTM) = 5	The servo drive is configured initially to adjust it to the used motor - P1-15 (RPO).
Dual modes		**SW-Pt** DINx = 18	Switching to **Pt** control mode can be chosen by digital input (DINx = 18).
		SW-Pr DINx = 19	Switching to **Pr** control mode can be chosen by digital input (DINx = 19).
		SW-S DINx = 20	Switching to **S** control mode can be chosen by digital input (DINx = 20).

The steps to choose the control mode are:

- Supply the power to the servo drive to become in ready condition (input function SON to be switched-off)
- Enter suitable control mode using parameter P1-00 (CTM) with the help of software package DriverCom.

To work with configuration package please refer to chapter 4 in this manual.

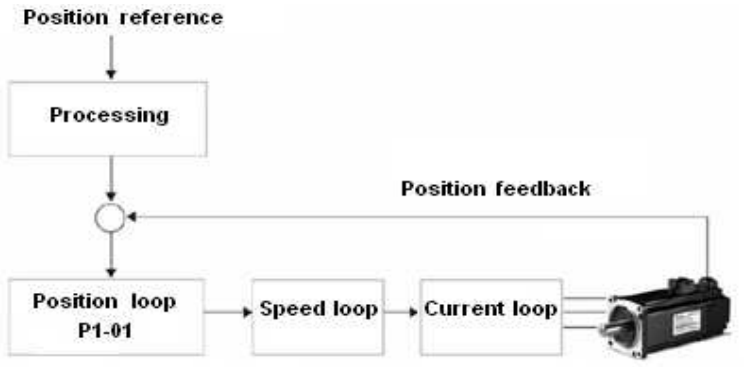
The following part describes the work of all control modes, including control structure, reference source, time diagrams and adjustments.

6.2. Operation modes with position control

Servo drives are configured in these modes, when operate in applications requiring precise positioning. Series servo drives ELAS support two types of reference sources - external (Pt) and internal (Pr):

- External position control mode Pt: (P1-00 (CTM) = 0).
- Internal position control mode Pr: (P1-00 (CTM) = 3).

6.2.1. Common structure of position control modes



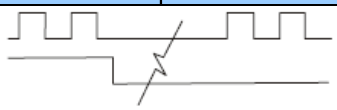
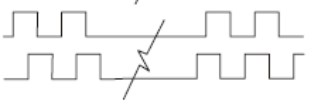
Control mode structure is built on the following blocks:
„Processing” – serve to convert and scale the chosen position reference
„Position loop” – P (proportional) position regulator
„Speed loop” – PI (proportional-integral) speed regulator
„Current loop” - PI (proportional-integral) current regulator

6.2.2. Position control mode with external source (Pt)

In this mode the source of position reference is usually controller (PLC) or a system with 2 pulse outputs. The reference consists of two pulse sequences connected to terminals of connector CN3 - PULSE (22), /PULSE (21) and SIGN (20), /SIGN (19).

Depending on the information they carry, they can be:

- Step + Direction – On inputs PULSE (22) and /PULSE (21) are supplied the differential signals of pulse sequence referencing the position, and on inputs SIGN(20) and /SIGN(19) are supplied differential signals referencing the direction of rotation.
- A + B phase-shifted pulse sequences – On inputs PULSE(22) and /PULSE(21) are supplied differential signals of pulse sequence A, and on inputs SIGN(20) and /SIGN(19) are supplied differential signals of pulse sequence B. The reference for position is the number of pulses, multiplied by 4, and direction of rotation becomes automatically from their phase shift.

Connection	Positive direction	Negative direction
Step + Direction		
A + B phase shifted		

Depending on the type of the used outputs, the receiving inputs can be:

Connection type	Maximal pulse frequency
Active output (Line driver)	500kpps
Open collector	200kpps

For wiring details – see chapter 3.

6.2.3. Position control mode with internal source (Pr)

The servo drive supports two methods for control in this mode.

- From parameters – this method allows entering up to 7 position references in corresponding parameters (POS1 (P2-36) to POS7 (P2-42)). After that, using input functions PC0~PC2 are executed the desired references.
- Reference by series channel – this method is used by controller (PLC) or system, supporting protocol for series communication (MODBUS). In this case the reference is applied directly in register P2-43 (POSM) with address 0384H.

Position reference	Speed reference by positioning	Input function			Source of reference	Parameter
		PC2	PC1	PC0		
POS0	PSPD (P1-11)	0	0	0	MODBUS	P2-43 Address 0384H(32bit)
POS1	SPD1 (P2-20)	0	0	1	Internal parameter	P2-36
POS2	SPD2 (P2-21)	0	1	0		P2-37
POS3	SPD3 (P2-22)	0	1	1		P2-38
POS4	SPD4 (P2-23)	1	0	0		P2-39
POS5	SPD5 (P2-24)	1	0	1		P2-40
POS6	SPD6 (P2-25)	1	1	0		P2-41
POS7	SPD7 (P2-26)	1	1	1		P2-42

Explanation:
Condition of PC0 to PC2: 0 switched-off
1 switched-on

NOTE

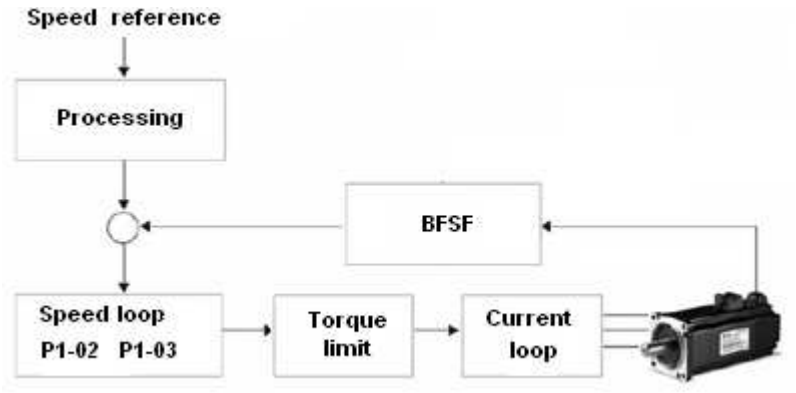
In this mode of operation it is necessary initially to be executed the zero return function (initial position) – by input functions ZRN or RFST.

6.3 Speed control modes – S, Sz

The servo drives are configured in this mode (S or Sz), when they operate in applications requiring precise control of the motor rotation speed. Series servo drives ELAS support two modes depending on the source:

- External speed control - mode S: (P1-00 (CTM) = 1).
- Internal speed control - mode Sz: (P1-00 (CTM) = 11).

6.3.1 Structure of speed control mode



The structure of this mode is built on the following blocks:
„Processing" – serves to convert and scale the chosen speed reference
„Speed loop" – PI speed regulator
„BFSF" – block formatting speed feedback signals from encoder
„Torque limit" – serves to limit the current regulator reference
„Current loop" - PI current regulator

6.3.2. Command source of speed control mode

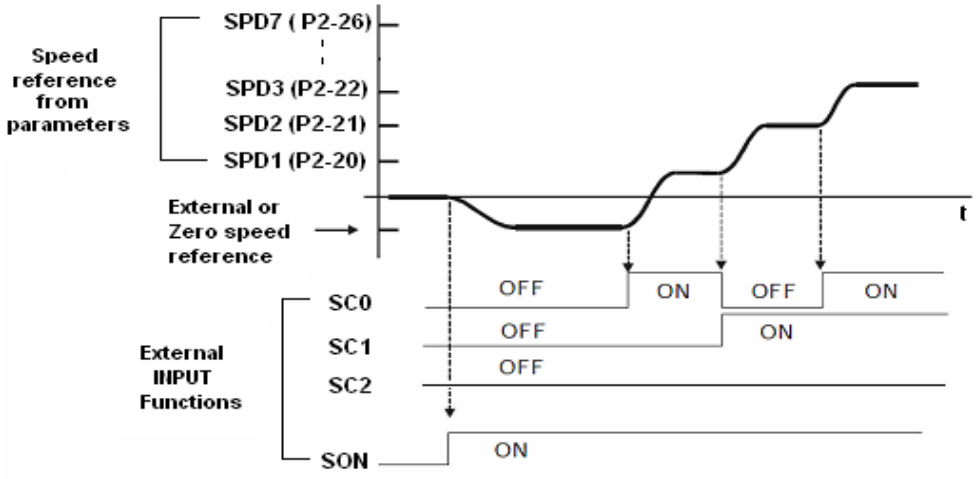
Series AC servo drives ELAS support three types of speed reference sources:

- Analog signal +/-10V – supplied on multifunctional analog input, the signal is converted by 14 bit analog to digital converter into speed reference.
- By internal parameters – there are adjusted different speed references in 7 parameters SPD1 (P2-20) to SPD7 (P2-26). After that by using input functions SC0 to SC2 are executed the desired references.
- Reference by series channel – this method is used when the source is controller (PLC) or system, supporting protocol for serial communication (MODBUS). In this case the reference is applied directly in register P2-27 (SPDM) with address 0210H.

Speed reference	Input function			Control mode	Analog function	Reference source	Description	Range
	SC2	SC1	SC0					
SP0	0	0	0	**S** CTM = 1 (P1-00)	AIN1 = 0 (P2-11)	SPDM (P2-27)	MODBUS	-5000 to 5000 rpm
					AIN1 = 1 (P2-11)	Analog input (ANL1)	Analog signal V-REF-GND	-10V to +10V
				Sz CTM = 11 (P1-00)	N/A Not announce	N/A Not announce	Speed reference is 0	0
SP1	0	0	1	SPD1 (P2-20)			Internal parameter	-5000 to 5000 rpm
SP2	0	1	0	SPD2 (P2-21)				
SP3	0	1	1	SPD3 (P2-22)				
SP4	1	0	0	SPD4 (P2-23)				
SP5	1	0	1	SPD5 (P2-24)				
SP6	1	1	0	SPD6 (P2-25)				
SP7	1	1	1	SPD7 (P2-26)				

Explanation: Condition of SC0 ~ SC2: 0 switched-off
1 switched-on

6.3.3. Timing chart of speed control mode



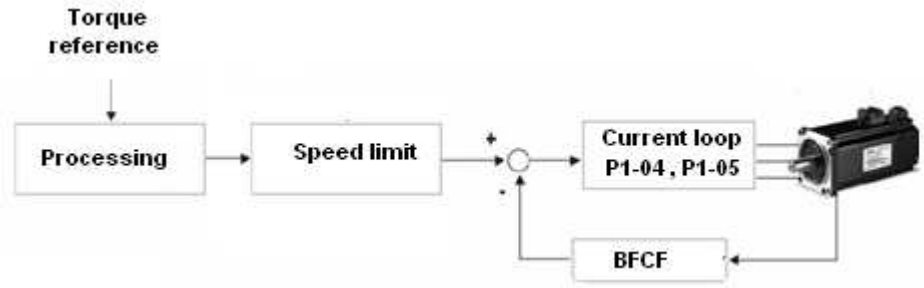
Explanation:
1) OFF means switched-off (1), ON means switched-on.
2) When the speed control mode is Sz, speed reference SPD0 = 0; When the speed control mode is S, the speed reference is from the analog input 1 (V-REF).
3) After activating of input function SON (operation permission), the user can choose the speed reference according to the condition of SC0~SC2.

6.4. Torque control mode

The torque control mode (T or Tz) is used usually in applications which require control of rotating torque of motor shaft, like in winding packing, textile, printing machines, etc. The series servo drives ELAS support two modes depending on the source:

- External torque control - mode T: (P1-00 (CTM) = 2).
- Internal torque control - mode Tz: (P1-00 (CTM) = 12).

6.4.1. Structure of torque control mode



The structure of this mode is built on the following blocks:
„Processing" – serves to convert and scale the chosen torque reference
„BFCF" – block formatting signals from current sensors feedback
„Speed limit" – serves to limit the speed of rotation
„Current loop" - PI current regulator

6.4.2. Command sources of torque control mode

Series AC servo drives ELAS support two types of torque reference sources:

- Analog signal +/-10V – supplied on multifunctional analog input, the signal is converted by 14 bit analog to digital converter into torque reference.
- By internal parameters – there are adjusted different torque references in 7 parameters TCM1 (P2-28) to TCM7 (P2-34). After that by using input functions TC0 to TC2 are executed the desired references.

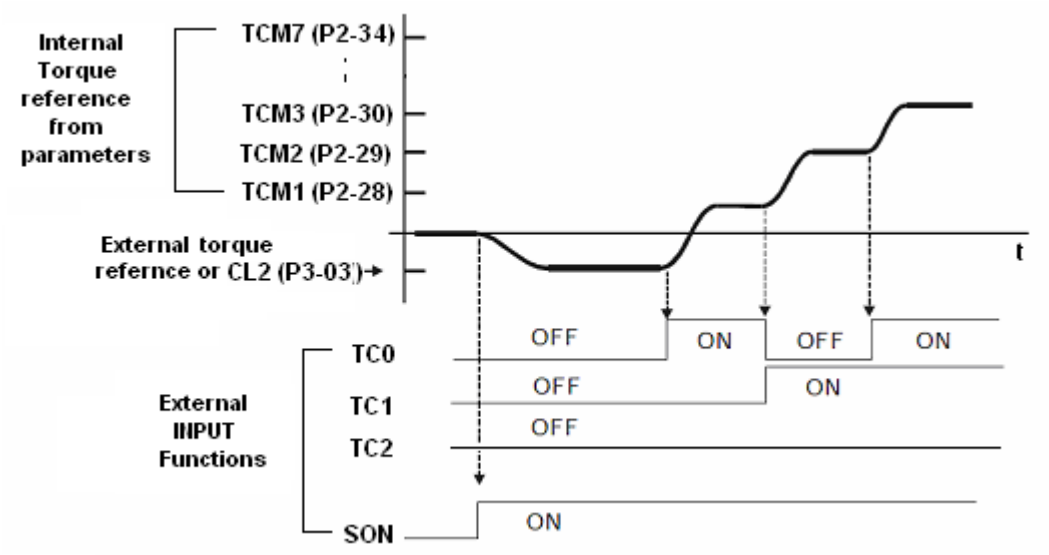
Torque reference	Input function			Control mode	Analog function	Reference source	Description	Speed limitation	
	TC2	TC1	TC0					AIN1 ≠ 1 (P2-11)	AIN1 = 1 (P2-11)
TR0	0	0	0	**T** CTM = 2 (P1-00)	AIN2 ≠ 1 (P2-14)	SCL (P3-02)	Max. reference 300 %	Zero speed	Analog input (ANL1) -10 to +10V
					AIN2 = 1 (P2-14)	Analog input (ANL2) -10 to +10V	Voltage signal T-REF-GND -10 до +10V		
				Tz CTM = 12 (P1-00)	N/A	N/A	Reference is 0		
TR 1	0	0	1	TRQ 1 (P2-28)			Internal parameter 0 ~ 300 %	SPD1(P2-20)	
TR 2	0	1	0	TRQ 2 (P2-29)				SPD2(P2-21)	
TR 3	0	1	1	TRQ 3 (P2-30)				SPD3 (P2-22)	
TR 4	1	0	0	TRQ 4 (P2-31)				SPD4 (P2-23)	
TR 5	1	0	1	TRQ 5 (P2-32)				SPD5(P2-24)	
TR 6	1	1	0	TRQ 6 (P2-33)				SPD6 (P2-25)	
TR 7	1	1	1	TRQ 7 (P2-34)				SPD7 (P2-26)	

Explanation: Condition of TC0 to TC2: 0 switched-off
1 switched-on

NOTE

The torque reference is accepted by absolute value, and direction is defined by the sign of the torque limitation.

6.4.3. Timing chart of torque control mode



Explanation:
1) OFF means switched-off (1), ON means switched-on.
2) When the control mode is **Tz**, torque reference TR0 = 0; When the control mode is **T**, the torque reference TRO is external analog source of voltage or referenced from parameter P3-02 (SCL)(maximum torque reference).
3) After activating of input function SON (operation permission), the user can choose the torque reference according to the condition of TC0 to TC2.

6.5. Functions

6.5.1. Function „Speed limit".

The sources of speed limitation are identical with these in speed control mode.
They can be –> external analog voltage, internal parameters (P2-20 to P2-26) or reference by series channel.

The limit of the speed is valid only in torque control mode (mode T,Tz) to avoid motor rotation above its maximal speed.

Speed limitation		**Torque reference**
AIN1 (P2-11) ≠ 1	AIN1 (P2-11) = 1	P1-00 (CTM) = 2 , 12 T , Tz modes
Zero speed	Analog input (ANL1) (-10V ~ +10V)	TR0
SPD1(P2-20)		TRQ1(P2-28)
SPD2 (P2-21)		TRQ2(P2-29)
SPD3 (P2-22)		TRQ3(P2-30)
SPD4 (P2-23)		TRQ4(P2-31)
SPD5 (P2-24)		TRQ5(P2-32)
SPD6 (P2-25)		TRQ6(P2-33)
SPD7 (P2-26)		TRQ7(P2-34)

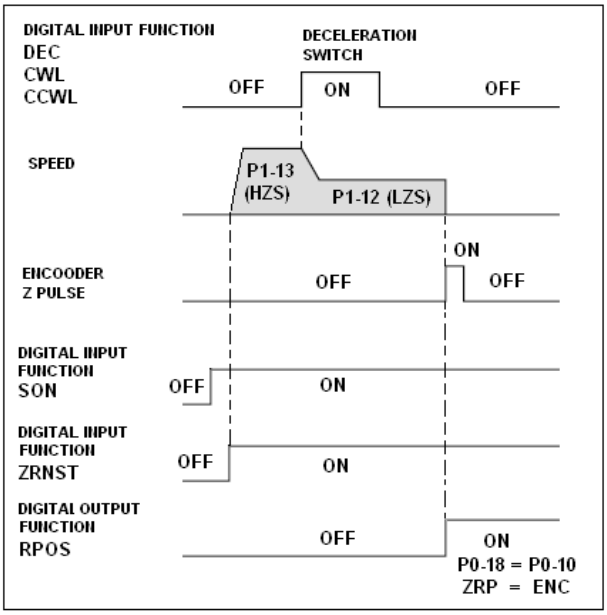
6.5.2 Function „Torque limit”

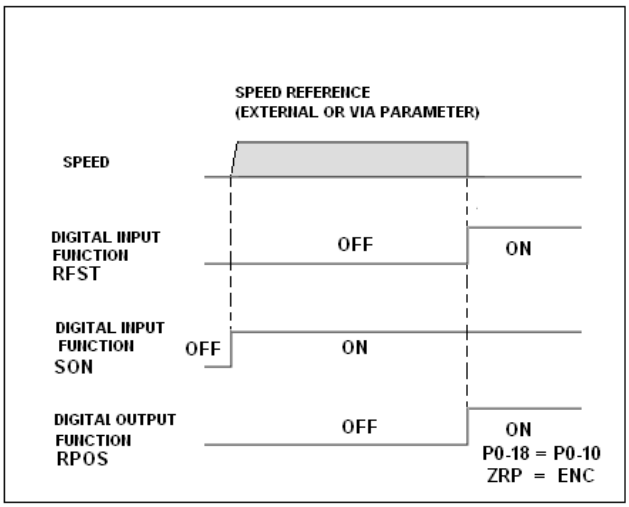
The sources of torque limitation are identical with these in torque control mode.
They can be –> external analog reference or internal parameters (P2-28 to P2-34).
The limitation of the torque is valid only in position control mode (mode Pt and Pr) and speed control mode (mode S and Sz).

Input function			**Control mode: Pt, Pr, S Torque limitation**	
TC2	TC1	TC0	AIN2 ≠ 1 (P2-14)	AIN2 = 1 (P2-14)
0	0	0	Maximal current limitation SCL(P3-02)	
0	0	1	TRQ1 (P2-28)	Analog input (ANL2) **T-REF- GND** (-10V до +10V)
0	1	0	TRQ2 (P2-29)	
0	1	1	TRQ3 (P2-30)	
1	0	0	TRQ4 (P2-31)	
1	0	1	TRQ5 (P2-32)	
1	1	0	TRQ6 (P2-33)	
1	1	1	TRQ7 (P2-34)	

6.5.3 Function „Zero return” (ZRN)

In operation with internal position control mode (**Pr**) it is necessary initially to be executed the following function. The found zero return point is co-ordinate point for the next position references. On the timing chart below are shown the 2 methods of function execution.





The **First method** is with the use of the Z signal from encoder. The function consists of 3 stages. After setting the servo drive in operation condition (SON is activated), it is started:
1-st stage – the motor is controlled by speed reference from parameter P1-13 (high speed on ZRN) until input signal is not activated from the switch for deceleration. The parameter for function on digital input can be (DEC or CWL or CCWL).
2-d stage – By first transition 0->1 on input function for deceleration switch, the speed reference is switched from second parameter P1-12 (low speed on ZRN).
3-d stage – By transition 1->0 of the input function for mill-cog, it is starting a search and stop at zero signal Z from the encoder. The current position of the encoder P0-10 (ENC) from the encoder is transferred on parameter P)-18 (ZRN) (zero return position) and it is activated output function RPOS (return position is found).
The **Second method** of “Finding zero return point – ZRN” is by using of input function RFST. By its activating the current position P0-10 (ENC) from encoder is transferred on parameter P0-18 (ZRP) (position of zero return point) and it is activated output function RPOS (Zero return point is found).

NOTE

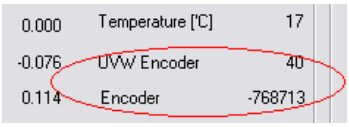
The function ZRN can be performed many times.
Parameters P1-13 (high speed of ZRN) and P1-12 (low speed of ZRN) are bi-polar. Their sign determines the direction for search of zero return point.

6.5.3 Function „Finding absolute rotor position - ARP ”

For trouble free and quality control of the brush-less motors with permanent magnets it is necessary only once to use this function. It is starting obligatory by initial run and automatically adjusts parameter P1-15 (RPO) – absolute rotor position.

Follow the next steps for correct execution of the function:

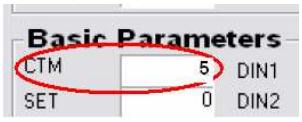
Step 1: Disconnect the motor from the coupling, belts, gears. Make it save from existing possibility to jump during execution of the procedure.
Step 2: Connect the servo drive to the motor and to the power supply , in accordance with wiring instruction (chapter 3).
Step 3: Connect the servo control to the PC to perform series communication (chapter 3).
Step 4: Start the software DriverCom and push button *Read*. Check, if servo drive is in condition ready and there is no alarms.
Step 5: Rotate the motor shaft by hand in CW direction, looking the two diagnostic parameters. Running position and the status of commutation signals.



For correct execution of function “Finding of absolute position of the rotor” **obligatory**:

- in the field Encoder – running position of the encoder decreases
- in the field UVW Encoder – to alternate conditions in the following order 60,40,50,10,30,20

By non-observance of the above conditions, switch-off the power supply, wait until capacitor battery fully discharges for about 5 minutes.
For observing the first condition change signals A<->AN in cable (CN4 – encoder)
For observing the second condition change the signal pairs U,UN <-> V,VN in the feedback cable (CN4 – encoder).
Repeat the instructions up to here to achieve the obligatory conditions
Step 6: Set P1-00 (CTM) = 5 – Auto adjustment of absolute position of the rotor **ARP**.



Step 7: Set P3-02 (SCL) = Rated current of the motor (temporary adjustment of the maximal current limitation).
Step 8: Push “Save Parameters” to preserve the new settings in the energy independent memory Flash. Then the servo drive is reset automatically and it is ready for operation.
Step 9: Push SON button to start the function. Check about errors and if the servo drive is in normal condition.
Step 10: During execution the green LED blinks with high frequency. Don't touch the motor shaft. Wait until procedure is ending. It is considered that the function is finished normally without alarm messages (the red LED is not activated).
Step 11: If the procedure ends normally, continue to *Step 12*. If procedure finishes with alarm message, change 2 of the power cables to the motor (for example U and V) and repeat the instructions up to here, beginning from *Step 5*.
Step 12: Switch-off SON button.
Step 13: Restore P1-00 (CTM) to the desired control mode.
Step 14: Restore P3-02 (SCL) - maximal current limitation of the servo drive.
Step 15: Push “Save Parameters” to save the new settings and the parameter for absolute rotor position in energy independent memory Flash. After that the servo drive is reset automatically and it is ready for operation.

7.1. Definition

Parameters of servo drives ELAS are separated in 5 groups:
Group 0: Diagnostic parameters (example: P0-xx)
Group 1: Basic parameters (example: P1-xx)
Group 2: Extended parameters (example: P2-xx)
Group 3: Limit parameters (example: P3-xx)
Group 4: Communication parameters (example: P4-xx)

Abbreviation of control modes:

Pt : External position control mode
Pr : Internal position control mode
S : Speed control mode
T: Torque control mode

Explanation of symbols (marked after parameter)

(☼) Read-only parameters
(●) Parameter is effective only after saving in energy independent memory "Flash"
(■) Parameters are not saved after switch-off

Group 0 P0-xx

Diagnostic parameters						
Parameter	**MODBUS address**	**Name**	**Explanation**	**Default**	**Dimension**	**Control mode**
P0-00 ☼	023BH	VER	Software version	-	-	Pt,Pr,S,T
P0-01 ☼	0300H	ALE	Alarm register	-	bit	Pt,Pr,S,T
P0-02 ☼	039CH	SOS0	Status output functions 0	-	bit	Pt,Pr,S,T
P0-03 ☼	039DH	SOS1	Status output functions 1	-	bit	Pt,Pr,S,T
P0-04 ☼	024FH	SIS0	Status input functions 0	-	bit	Pt,Pr,S,T
P0-05 ☼	0250H	SIS1	Status input functions 1	-	bit	Pt,Pr,S,T
P0-06 ☼	0251H	SIS2	Status input functions 2	-	bit	Pt,Pr,S,T
P0-07 ☼			Not used	-		
P0-08 ☼	038CH	ANL1	Status of analog input 1 (V-REF)	-	Volt	Pt,Pr,S,T
P0-09 ☼	038DH	ANL2	Status of analog input 2 (T-REF)	-	Volt	Pt,Pr,S,T
P0-10 ☼	036FH	ENC	Register for feedback connection according position (32bit)	-	pulse	Pt,Pr,S,T
P0-11 ☼	022DH	PSM	Position reference in Pt mode (32bit)	-	pulse	Pt
P0-12 ☼	0288H	UVW	Status communication signals	-	-	Pt,Pr,S,T
P0-13 ☼	0293H	SPF	Register speed feedback (32 bit)	-	RPM	Pt,Pr,S,T
P0-14 ☼	0386H	PER	Counter position error	-	pulse	Pt,Pr
P0-15 ☼	0369H	SER	Counter speed error	-	pulse	Pt,Pr,S,T
P0-16 ☼	0379H	DCM	Main DC voltage	-	Volt	Pt,Pr,S,T
P0-17 ☼	037AH	THM	Temperature of IGBT power module	-	°C	Pt,Pr,S,T
P0-18 ☼	0382H	ZRP	Position of zero return point (32 bit)	-	pulse	Pt,Pr
P0-19 ■	0280H	COMP1	Position for comparison 1 (32 bit)	-	pulse	Pt,Pr,S,T
P0-20 ■	0282H	COMP2	Position for comparison 2 (32 bit)	-	pulse	Pt,Pr,S,T

Group 1 P1-xx

Basic parameters						
Parameter	**MODBUS address**	**Name**	**Explanation**	**Default**	**Dimension**	**Control mode**
P1-00 ●	0308H	CTM	Control mode	0	-	Pt,Pr,S,T
P1-01	032Ah	KPP	Proportional position loop gain	1000	-	Pt,Pr
P1-02	030CH	KVP	Proportional speed loop gain	54.500	-	Pt,Pr,S
P1-03	030DH	KVI	Integral speed loop gain	0.313	-	Pt,Pr,S
P1-04	030AH	KIP	Proportional current loop gain	1.500	-	Pt,Pr,S,T
P1-05	030BH	KII	Integral current loop gain	0.033	-	Pt,Pr,S,T
P1-06 ●	0326H	ADT	Acceleration/Deceleration time (RAMP)	0	mS	S,T
P1-07	031FH	VCM	Speed command multiplier	1.000	-	Pt,Pr,S
P1-08	032CH	B1M	Electronic gear (1-st multiplier of position reference)	1.000	-	Pt
P1-09	032Dh	B2M	Electronic gear (1-nd multiplier of position reference)	5.000	-	Pt

P1-10	0359H	INP	In-position zone	1	pulse	Pt,Pr
P1-11	0328H	PSPD	Speed in position mode and function "JOG" (rotation)	500	RPM	Pt,Pr,S,T
P1-12	0332H	LZS	Low speed by function ZRN	12	RPM	Pt,Pr
P1-13	032BH	HZS	High speed by function ZRN	100	RPM	Pt,Pr
P1-14	0333H	ZCL	Zero clamp width	5	RPM	S
P1-15	0324H	RPO	Absolute rotor position	-224	pulse	Pt,Pr,S,T
P1-16	032EH	ENT	Position feedback type	0	-	Pt,Pr,S,T
P1-17 ■	0315H	SET	Special function	0	-	Pt,Pr,S,T
P1-18	0314H	MTR	Motor type	0	-	Pt,Pr,S,T

Group 2 P2-xx

Extended parameters						
Parameter	**MODBUS address**	**Name**	**Explanation**	**Default**	**Dimension**	**Control mode**
P2-00	0313H	DRT	Filter on digital inputs	2	ms	Pt,Pr,S,T
P2-01 ●	0319H	DIN1	Input function on terminal IN1 - CN3.17	101	-	Pt,Pr,S,T
P2-02 ●	031AH	DIN2	Input function on terminal IN2 - CN3.18	106	-	Pt,Pr,S,T
P2-03 ●	031BH	DIN3	Input function on terminal IN3 - CN3.5	21	-	Pt,Pr,S,T
P2-04 ●	031CH	DIN4	Input function on terminal IN4 - CN3.3	22	-	Pt,Pr,S,T
P2-05 ●	031EH	DIN5	Input function on terminal IN5 - CN3.15	13	-	Pt,Pr,S,T
P2-06 ●	0329H	DIN6	Input function on terminal IN6 - CN3.22	0	-	Pt,Pr,S,T
P2-07 ●	032FH	DIN7	Input function on terminal IN7 - CN3.20	0	-	Pt,Pr,S,T
P2-08 ●	0338H	DOUT1	Output function on terminal OUT1-CN3.16	101	-	Pt,Pr,S,T
P2-09 ●	0339H	DOUT2	Output function on terminal OUT2 - CN3.2	107	-	Pt,Pr,S,T
P2-10 ●	033AH	DOUT3	Output function on terminal OUT3 - CN3.1	105	-	Pt,Pr,S,T
P2-11 ●	0336H	AIN1	Function on analog Input 1(VREF)-CN3.9	1	-	Pt,Pr,S,T
P2-12	0334H	A1LV	Analog input threshold 1(V-REF) – CN3.9	4.800	Volt	Pt,Pr,S,T
P2-13	0307H	A1OF	Analog input offset 1(V-REF)-CN3.9	0.000	Volt	Pt,Pr,S,T
P2-14	0337H	AIN2	Function on analog input 2(T-REF)–CN3.6	0	-	Pt,Pr,S,T
P2-15	0316H	A2OF	Analog input offset 2(T-REF)–CN3.6	4.800	Volt	Pt,Pr,S,T
P2-16	0335H	A2LV	Analog input level 2(T-REF) – CN3.6	0.000	Volt	Pt,Pr,S,T
P2-17	035AH	A1M	Analog input multiplier 1(V-REF)	1.000	-	Pt,Pr,S,T
P2-18	035BH	A2M	Analog input multiplier 2 (T-REF)	1.000	-	Pt,Pr,S,T
P2-19			Not used			
P2-20 ●	033BH	SPD1	1-st speed reference/limit	0	RPM	Pr,S,T
P2-21 ●	033CH	SPD2	2-nd speed reference/limit	100	RPM	Pr,S,T
P2-22 ●	033DH	SPD3	3-rd speed reference/limit	200	RPM	Pr,S,T
P2-23 ●	033EH	SPD4	4-th speed reference/limit	1000	RPM	Pr,S,T
P2-24 ●	033FH	SPD5	5-th speed reference/limit	-500	RPM	Pr,S,T
P2-25 ●	0340H	SPD6	6-th speed reference/limit	-400	RPM	Pr,S,T
P2-26 ●	0341H	SPD7	7-th speed reference/limit	-100	RPM	Pr,S,T
P2-27 ■	0210H	SPDM	Speed reference/limit by serial interface (MODBUS protocol)	-	RPM	S,T
P2-28 ●	0342H	TRQ1	1-st torque reference/limit	0.200	A	Pt,Pr,S,T
P2-29 ●	0343H	TRQ2	2-nd torque reference/limit	0,400	A	Pt,Pr,S,T
P2-30 ●	0344H	TRQ3	3-rd torque reference/limit	0,600	A	Pt,Pr,S,T
P2-31 ●	0345H	TRQ4	4-th torque reference/limit	0,800	A	Pt,Pr,S,T
P2-32 ●	0346H	TRQ5	5-th torque reference/limit	1,000	A	Pt,Pr,S,T
P2-33 ●	0347H	TRQ6	6-th torque reference/limit	1,200	A	Pt,Pr,S,T
P2-34 ●	0348H	TRQ7	7-th torque reference/limit	1,400	A	Pt,Pr,S,T
P2-35 ■	02xxH	TRQM	Torque reference/limit by serial interface (MODBUS protocol)	-	A	Pt,Pr,S,T
P2-36 ●	0349H	POS1	1-st position reference (32 bit)	0	pulse	Pr
P2-37 ●	034BH	POS2	2-nd position reference (32 bit)	10000	pulse	Pr
P2-38 ●	034DH	POS3	3-rd position reference (32 bit)	20000	pulse	Pr
P2-39 ●	034FH	POS4	4-th position reference (32 bit)	30000	pulse	Pr
P2-40 ●	0351H	POS5	5-th position reference (32 bit)	40000	pulse	Pr
P2-41 ●	0353H	POS6	6-th position reference (32 bit)	-20000	pulse	Pr
P2-42 ●	0355H	POS7	7-th position reference (32 bit)	-10000	pulse	Pr
P2-43 ■	0384H	POSM	Position reference by serial interface (MODBUS protocol)	-	pulse	Pr
P2-44	0398H	SI0	Register reference input functions 0 by serial interface (MODBUS protocol)	-	-	Pt,Pr,S,T

P2-45	0399H	SI1	Register reference input functions 1 by serial interface (MODBUS protocol)	-	-	Pt,Pr,S,T
P2-46	039AH	SI2	Register reference input functions 2 by serial interface (MODBUS protocol)	-	-	Pt,Pr,S,T
P2-47			Not used			
P2-48			Not used			
P2-49	035CH	ZSP	Zero speed threshold „ZSPD" output	10	RPM	Pt,Pr,S,T
P2-50	035DH	TSP	Rotating speed threshold „TSPD" output	500	RPM	Pt,Pr,S,T
P2-51	0325H	TCR	Motor current threshold „TCUR" output	1.000	A	Pt,Pr,S,T

Group 3 P3-xx

Limit parameters						
Parameter	**MODBUS address**	**Name**	**Explanation**	**Default**	**Dimension**	**Control mode**
P3-00	0309H	HSR	Range of measured currents (set by manufacturer)	19.500	A	Pt,Pr,S,T
P3-01	0311H	IPM	Setting current protection threshold (set by manufacturer)	15.000	A	Pt,Pr,S,T
P3-02	030EH	SCL	Setting maximal current limit	12.000	A	Pt,Pr,S,T
P3-03	0318H	CL2	300% x Rated motor current for alarm "Motor overload"	2.700	A	Pt,Pr,S,T
P3-04	030FH	CL1	120% x Rated motor current for alarm "Motor overload"	1.000		Pt,Pr,S,T
P3-05	0310H	OVL	Type overload characteristics depending on the motor	0	-	Pt,Pr,S,T
P3-06	0317H	VCC	Calibration DC voltage (set by manufacturer)	1.000	Volt	Pt,Pr,S,T
P3-07	0320H	VHL	Voltage threshold for protection „Overvoltage"	390.00	Volt	Pt,Pr,S,T
P3-08	0321H	VLL	Voltage threshold for protection „Low voltage"	0.00	Volt	Pt,Pr,S,T
P3-09	0322H	BRL	Voltage threshold for switching-on the braking resistor	360.00	Volt	Pt,Pr,S,T
P3-10	0323H	THL	Temperature threshold for protection "Servo drive over-heating"	105	°C	Pt,Pr,S,T
P3-11	0312H	ARM	Register alarm mask (set by manufacturer)	2BFF	bit	Pt,Pr,S,T

Group 4 P4-xx

Communication parameters						
Parameter	**MODBUS address**	**Name**	**Explanation**	**Default**	**Dimension**	**Control mode**
P4-00 ●	0327H	ADR	MODBUS address of servo drive	4	-	Pt,Pr,S,T
P4-01 ●	0357H	SCI	Adjustments of communication	0	-	Pt,Pr,S,T
P4-02	0358H	CDT	Delay by communication	0	ms	Pt,Pr,S,T

Symbol explanation (marked after parameter)
(☼) Read-only parameters
(●) Parameter is effective only after saving in energy independent memory "Flash"
(■) Parameters are not saved after switch-off

7.2. Detailed parameter listing
Group 0: P0-xx Diagnostic parameters

P0-00 ☼	VER	Software version	MODBUS Address **032BH**

Setting: Factory setting
Applicable control mode: Pt,Pr,S,T
Dimension:
Range:
Description: The basic software version of the servo drive is read

Additional description:
N/A

P0-01 ☼	ALE	Alarms register	MODBUS Address **0300H**

Setting:
Applicable control mode: Pt,Pr,S,T
Dimension: bit addressing
Range: 1 to FFFF
Description: Reading the alarm condition of the servo drive
Bit0 = Signal error about absolute position of the rotor (note 1)
Bit1 = Signal error from encoder (note 1)
Bit2 = Motor overload (note 1)
Bit3 = Servo overheat (note 1)
Bit4 = Overvoltage (note 1)
Bit5 = Undervoltage (note 1)
Bit6 = Overcurrent (note 1)
Bit7 = IGBT power module fault (note 1)
Bit8 = Breaking resistor error (note 1)
Bit9 = Position reference error (note 1)
Bit10 = Communication error (note 1)
Bit11 = Analog to digital converter ADC error (note 1)
Bit12 = Emergency stop activated (note 2)
Bit13 = DSP error (note 1)
Bit14 = Current limit (note 2)
Bit15 = Speed limit (note 2)

Additional description:
Chapter10

NOTE

1) When this fault occurs, the user can use ARST or SON signal to clear the fault message.
2) This error can be cleared automatically when user eliminate the error source. Using ARST or SON signal can not clear this fault message.

P0-02 ☼	SOS0	Status output functions 0	MODBUS Address **039CH**

Setting:
Applicable control mode: Pt,Pr,S,T
Dimension: bit addressing
Range: 1 to FFFF
Description: Reading condition of register output functions 0. When corresponding bit is active (logical 1) it means:
Bit 0 = **SRDY** - servo ready for operation
Bit 1 = **SON** - servo permission to operate
Bit 2 = **ZSPD** - zero speed of the motor
Bit 3 = **TSPD** - zero speed achieved
Bit 4 = **TPOS** - position completed
Bit 5 = **TQL** - in torque limit
Bit 6 = **ALRM** - in alarm condition
Bit 7 = **BRKR** - electromagnetic break switched-on
Bit 8 = **OLW** - overload warning
Bit 9 = **WARN** - output servo warning
Bit 10 = **BRKD** - break resistor switched-on
Bit 11 = **RPOS** - zero return position found
Bit 12 to Bit 15 - not used

Additional description:
Table 3.C

P0-03 ☼	SOS1	Status output functions 1	MODBUS Address **039DH**

Setting: Additional description:
Applicable control mode: Pt,Pr,S,T Table 3.C
Dimension: bit addressing
Range: 1 to FFFF
Description: Reading condition of register output functions 1. When corresponding bit is active (logical 1) it means:
Bit 0 = **TCUR** - Achieved current
Bit 1 to bit 15 - not used

P0-04 ☼	SIS0	Status input functions 0	MODBUS Address **024FH**

Setting: Additional description:
Applicable control mode: Pt,Pr,S,T Table 3.B in Chapter 3
Dimension: bit addressing
Range: 1 to FFFF
Description: Reading condition of register input functions 0. When corresponding bit is active (logical 1) it means:
Bit 0 = **SON** Servo permission to operate (servo ON)
Bit 1 = **ARST** Alarm reset
Bit 2 = **DBLK** Deblock ROTATION
Bit 3 = **CCLR** Clear register position deviation in Pt mode
Bit 4 = **ZCLM** Function „CLAMP SPEED REFERENCE" is active
Bit 5 = **CMDINV** Function „Command inverse" is active
Bit 6 = **INHP** Position reference in Pt mode is invalid
Bit 7 = **STEP** Function „Step performance" is active
Bit 8 = **OHM** Motor Overheated
Bit 9 = **GNM** Electronic gear is chosen with ratio – parameter B2M
Bit 10 = **SPD0** Lowest bit of speed reference from parameter is active
Bit 11 = **SPD1** First bit of speed reference from parameter is active
Bit 12 = **SPD2** Second bit of speed reference from parameter is active
Bit 13 = **EMGS** Emergency stop is active
Bit 14 and Bit 15 not used

P0-05 ☼	SIS1	Status input functions 1	MODBUS Address **0250H**

Setting: Additional description:
Applicable control mode: Pt,Pr,S,T Table 3.B in Chapter 3
Dimension: bit addressing
Range: 1 to FFFF
Description: Reading condition of register input functions 1. When corresponding bit is active (logical 1) it means:
Bit 0 = **TC0** Null bit of torque reference from parameter is active
Bit 1 = **TC1** First bit of torque reference from parameter is active
Bit 2 = **TC2** Second bit of torque reference from parameter is active
Bit 3 = **SW-Pt** Position control mode Pt is chosen
Bit 4 = **SW-Pr** Position control mode Pr is chosen
Bit 5 = **SW-S** Speed control mode S is chosen
Bit 6 = **CWL** Negative speed reference (clockwise direction) is forbidden
Bit 7 = **CCWL** Positive speed reference (counter clockwise direction) is forbidden
Bit 8 = **PC0** Null bit of position reference from parameter is active
Bit 9 = **PC1** First bit of position reference from parameter is active
Bit 10 = **PC2** Second бит от заданието за позиция от параметър е активен
Bit 11 = **DEC** Referenced low speed for searching zero return point (mill-cog)
Bit 12 = **ZRNST** Function „Searching zero return point" is started.
Bit 13 = **RFST** Zero return is set
Bit 14 and Bit 15 not used

P0-06 ☼	SIS2	Status input functions 2	MODBUS Address **0251H**

Setting: Additional description:
Applicable control mode: Pt,Pr,S,T Table 3.B in Chapter 3
Dimension: bit addressing
Range: 1 to FFFF
Description: Reading condition of register input functions 2. When corresponding bit is active (logical 1) it means:
Bit 0 = **JOG +** Positive speed referenced from parameter PSPD
Bit 1 = **JOG -** Negative speed referenced from parameter PSPD
Bit 2 to Bit 15 not used

P0-07 ☼		Reserved	MODBUS Address

P0-08 ☼	ANL1	Status of analog input 1 (V-REF)	MODBUS Address **038CH**

Setting: Additional description:
Applicable control mode: Pt,Pr,S,T Table 3.A in Chapter 3
Dimension: V
Range: -10.000 to 10.000
Description: Reading signal value supplied to analog input V-REF/GNDA

P0-09 ☼	ANL2	Status of analog input 2 (T-REF)	MODBUS Address **038DH**

Setting: Additional description:
Applicable control mode: Pt,Pr,S,T Table 3.A in Chapter 3
Dimension: V
Range: -10.000 to 10.000
Description: Reading signal value supplied to analog input T-REF/GNDA

P0-10 ☼	ENC	Register position feedback (32 bit)	MODBUS Address **036FH** **0370H**

Setting: Additional description:
Applicable control mode: Pt,Pr,S,T item 3.3 in Chapter 3
Dimension: pulse
Range: -2147483647 to 2147483648
Description: Represents the running position of the motor. The number of encoder pulses is multiplied by 4 and is registered in this parameter.

P0-11 ☼	PSM	Position reference in Pt mode (32 bit)	MODBUS Address **022DH** **022EH**

Setting: Additional description:
Applicable control mode: Pt,Pr,S,T Chapter 6
Dimension: pulse
Range: -2147483647 to 2147483648
Description: Represents current position reference from external source. The pulses supplied to inputs PULS/SIGN are formatted depending on the chosen electronic gear and are registered in this parameter.

P0-12 ☼	UVW	Status commutation signals	MODBUS Address **0288H**

Setting: Additional description:
Applicable control mode: Pt,Pr,S,T Chapter 6 Other functions
Dimension:
Range: 10 to 60
Description: Gives information about current pole sector. It is used for diagnostic and feedback when finding the absolute position of the rotor.

P0-13 ☼	SPF	Register of the speed feedback (32 bit)	MODBUS Address **036CH**

Setting: Additional description:
Applicable control mode: Pt,Pr,S,T
Dimension: RPM
Range: -32000 до 32000
Description: Represents current speed of the motor. Encoder pulses are integrated with definite tact to be converted in speed and to be accumulated in this parameter.

P0-14 ☼	PER	Position error counter	MODBUS Address **0386H**

Setting: Additional description:
Applicable control mode: Pt,Pr
Dimension: pulse
Range: -32767 to 32767
Description: Represents the error on position regulator input in position control modes Pt, Pr.

P0-15 ☼	SER	Speed error counter	MODBUS Address **0369H**

Setting: Additional description:
Applicable control mode: Pt,Pr,S
Dimension: pulse
Range: -32767 to 32767
Description: Represents the error on speed regulator input in position and speed control modes Pt, Pr, S.

P0-16 ☼	DCM	Main DC Voltage	MODBUS Address **0379H**

Setting: Additional description:
Applicable control mode: Pt,Pr,S,T
Dimension: V
Range: 0 to 1000
Description: Represents the value of main DC voltage on rectifying block in the servo drive. Serves as a base for adjustment and feedback of voltage status protections and switching-on of breaking resistor. To calibrate the voltage value see parameter P3-06 (VCC).

P0-17 ☼	THM	Temperature of IGBT power block	MODBUS Address **037AH**

Setting: Additional description:
Applicable control mode: Pt,Pr,S,T
Dimension: °C
Range: 0 to 150
Description: Shows the temperature of IGBT power module. Serves as a base for adjustment and feedback of the overheat protection of the servo drive.

P0-18 ☼	ZRP	Zero return position (32 bit)	MODBUS Address **0382H**

Setting: Additional description:
Applicable control mode: Pt,Pr,S,T
Dimension: pulse
Range: -2147483647 to 2147483648
Description: Represents the coordinates of null position after execution of function “Finding zero return point ZRN”

P0-19 ■	COMP1	Position to compare 1 (32 bit)	MODBUS Адрес **0280H**

Setting: Additional description:
Applicable control mode: Pt,Pr,S,T
Dimension: pulse
Range: -2147483647 to 2147483648
Description: The referenced value of this parameter during operation is compared with current position of the encoder and it is smaller the output CMR1 is activated. For example if the user sets **P0-19** = 10000 and current position feedback is **P0-10** = 12345, than the output function CMP1 will be active.

P0-20 ■	COMP2	Position to compare 2 (32 bit)	MODBUS Address **0282H**

Setting: 0 Additional description:
Applicable control mode: Pt,Pr,S,T Chapter 6
Dimension: pulse
Range: -2147483647 to 2147483648
Description: The referenced value of this parameter during operation is compared with current position of the encoder and it is smaller the output CMR2 is activated. For example if the user sets **P0-19** = 14000 and current position feedback is **P0-10** = 12345, than the output function CMP2 will be active.

Group 1: P1-xx Basic parameters

P1-00 •	CTM	Control mode	MODBUS Address **0308H**

Setting: 0
Applicable control mode: Pt,Pr,S,T
Dimension:
Range: 0 to 12
Additional description:
Chapter 6

Description: This parameter defines the basic control mode. Depending on the application the servo drive is obliged to choose the suitable basic control mode , and with the help of additional input functions – SW-Pt, SW-Pr, SW-S to pass to additional modes of control. The Settings of the parameters are as follows:

0 – Pt - Position control mode with external reference
1 – S - Speed control mode with external reference**,** parameters or MODBUS
2 – T - Torque control mode with external reference or parameters.
3 – Pr - Position control mode with internal reference**,** parameters or MODBUS
5 – ARP - Auto-adjust absolute rotor position of the motor
11 – Sz - Speed control mode with internal reference from parameters
12 - Tz - Torque control mode with internal reference from parameters

P1-01	KPP	Proportional position loop gain	MODBUS Address **032AH**

Setting: 1.000
Applicable control mode: Pt,Pr
Dimension:
Range: 0.000 to 7.999
Additional description:
Chapter 6

Description: This parameter represents proportional part of position regulator. It is used to set the position loop gain. When the adjusted value of **KPP** is bigger, the position loop reaction is faster, the position error is smaller and settle time is smaller. If the gain is exceeding too much, the mechanical system can be excited during positioning.
When a new unknown machine is adjusted, the value of **KPP** is increased gradually by applying rectangle input signal, until servo drive becomes excited (resonance), after which the value of **KPP** decreases.

P1-02	KVP	Proportional speed loop gain	MODBUS Address **030CH**

Setting: 50.000
Applicable control mode: Pt,Pr,S,T
Dimension:
Range: 0.000 to 7.999
Additional description:
Chapter 6

Description: This parameter represents proportional part of speed regulator. It is used to set the speed loop gain. When the adjusted value of **KVP** is bigger, the speed loop reaction is faster, the speed error is smaller and settle time is smaller.
When the adjusted gain is exceeding too much, this can cause exciting and noise (vibration) in mechanical system. If the responsiveness of the position loop is faster than of the speed loop, the mechanical system can generate vibrations and noise, or even to be excited during positioning.

P1-03	KVI	Integral part of speed loop gain	MODBUS Address **030DH**

Setting: 0.300
Applicable control mode: Pt,Pr,S,T
Dimension:
Range: 0.000 to 1.999
Additional description:
Chapter 6

Description: This parameter represents integral part (reciprocal of integral time constant) of the speed regulator. Its function is to null the static error on the speed regulator input. When the adjusted value of **KVI** is increased, deviation from speed reference decreases.
When the adjusted gain is exceeding too much, this can cause excitation and noise (resonance in the mechanical system). When a new unknown machine is adjusted, the values of **KPV** and **KIV** are increased gradually by applying rectangle input signal, until servo drive becomes excited (resonance), after which their values have to be decreased.

P1-04	KIP	Proportional current loop gain	MODBUS Address **030AH**

Setting: 1.500
Applicable control mode: Pt,Pr,S,T
Dimension:
Range: 0.000 to 7.999
Additional description:
Chapter 6
Description: This parameter represents proportional part of current regulator. This parameter is used to set proportional part of current loop gain. The current loop gains are adjusted by the manufacturer depending on the used motor and in most cases there is no need for additional Setting.
When the adjusted gain **KPI** is bigger, the reaction of current loop is faster, the error on the input is smaller and responding time is also smaller. When the adjusted value is too high, this can cause excitation (resonance in mechanical system).
If the responsiveness of the speed loop is bigger that of the current loop, the mechanical system can generate vibrations or noise, or even to become excited during positioning.

P1-05	KII	Integral part of current loop gain	MODBUS Address **030BH**

Setting: 0.035
Applicable control mode: Pt,Pr,S,T
Dimension:
Range: 0.000 to 0.799
Additional description:
Chapter 6
Description: This parameter represents integral part of current regulator(reciprocal of time constant for integration). Its function is to null the static error in the regulators input. The current regulator gains are adjusted by the manufacturer depending on the used motor and in most cases it is not necessary to adjust them additionally.
When the value of **KII** is increased, it decreases deviation from current reference.
When the adjusted value is too high, it can cause exciting and noise (resonance in mechanical system).

P1-06 •	ADT	Acceleration and deceleration time (ramp)	MODBUS Address **0326H**

Setting: 0.000
Applicable control mode: S,T
Dimension: ms
Range: 0 to 6000
Additional description:
Description: It is used to set the time for acceleration and deceleration in speed and torque control modes. When this parameter is 0 or it is chosen position control (P1-00 = 0,3) - the function for acceleration and deceleration during operation with this time constant is forbidden.

P1-07	VCM	Speed multiply constant	MODBUS Address **031FH**

Setting: 1.000
Applicable control mode: Pt,Pr,S,T
Dimension:
Range: Pt, Pr mode 0 to 7.999
S, T mode -7.999 to 7.999
Additional description:
Description: In **Position control mode** this parameter is used to decrease the error by positioning and decrease the time for entering in position.
In **Speed control mode** this parameter is multiply constant for speed reference.
In **Torque control mode** this parameter is multiply constant for speed limit reference.
For example, in speed control mode, if p1-07 is set to 1.500 and speed reference is +1000 RPM, than the speed reference is +1500 RPM. If P1-07 is set to -2.123 and speed reference is +1000 RPM, than the speed reference changes to -2123 RPM.

P1-08	B1M	Electronic gear (1st multiplier of the reference for position control mode Pt)	MODBUS Address **032CH**
P1-09	B2M	Electronic gear (2nd multiplier of the reference for position control mode Pt)	MODBUS Address **032DH**

Setting: 0.500 (B1M) 1.500 (B2M)
Applicable control mode: Pt
Range: -199.000 to 199.000
Additional description:
Input function GNM in Tbl 3.C

Description: They are used to scale the position reference .

P1-10	INP	Position completed zone	MODBUS Address **0359H**

Setting: 10 Additional description:
Applicable control mode: Pt , Pr output function TPOS (5) in Table 3.B
Dimension: pulse
Range: 1 to 10000
Description: In position control mode Pt or Pr, the output function TPOS will be activated, when the difference between the referenced and real position is equal or less than the adjusted, defined in this parameter.

P1-11	PSPD	Speed in position mode and function JOG (rotation)	MODBUS Address **0328H**

Setting: 500,000 Additional description:
Applicable control mode: Pt , Pr,S,T input function JOG+,JOG-in Table 3.C
Dimension: RPM
Range: 0 to 6000
Description: In position control mode by internal reference (P1-00 = 3) this parameter is used to set the positioning speed. The other function is to define the speed in JOG mode (rotation).

P1-12	LZS	Low speed by function ZRN	MODBUS Address **0332H**

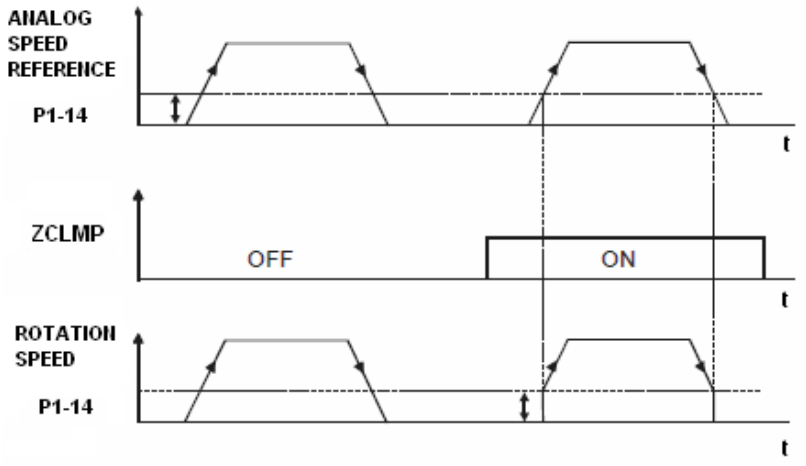
Setting: 10,000 Additional description:
Applicable control mode: Pt , Pr Chapter 6
Dimension: RPM
Range: -500.000 to 500.000
Description: This parameter defines the low speed during execution of function “Finding zero return point”.

P1-13	HZS	High speed by function ZRN	MODBUS Address **032BH**

Setting: 200,000 Additional description:
Applicable control mode: Pt , Pr Chapter 6
Dimension: RPM
Range: -500.000 to 500.000
Description: This parameter defines the high speed during execution of function “Finding zero return point”.

P1-14	ZCL	Zero clamp threshold	MODBUS Address **0333H**

Setting: 10.000 Additional description:
Applicable control mode: S, T input function ZCLMP(5) in Table 3.C
Dimension: RPM
Range: 0 to 500.000
Description: When input function ZCLMP is activated and analog speed reference is lower than the value in P1-14 (ZCL), it is executed reference for zero speed (“clamp” the motor in current position). The function is active only by analog speed reference.



P1-15 ●	RPO	Absolute rotor position	MODBUS Address **0324H**

Setting: -224 Additional description:
Applicable control mode: Pt,Pr,S, T Chapter 6
Dimension: pulse
Range: -32767 до 32767
Description: This parameter is adjusted automatically in operation mode “Setting of absolute rotor position”.

P1-16 ●	ENT	Type of position feedback	MODBUS Адрес **032EH**

Setting: 0 Additional description:
Applicable control mode: Pt,Pr,S, T
Dimension:
Range: 0 to 2
Description: This parameter is used to set the options of position feedback:
0 - Incremental encoder with commutation signals (A,/A, B,/B, C,/C ,U,/U, V,/V, W,/W)
1 - Incremental encoder without commutation signals (A,/A, B,/B, C,/C).(see the Note)
2 - Less-wire incremental encoder F1 (etc Delta Electronics)

NOTE

In this case after activating function SON, the motor will initially rotate on ¼ revolution (defining absolute position), after that will continue in corresponding control mode. Defining of absolute position is only once until the power off.

P1-17	SET	Special function	MODBUS Address **0315H**

Setting: 0 Additional description:
Applicable control mode: Pt,Pr,S, T
Dimension:
Range: 0 to 32767
Description: This parameter is used to restore all parameters to their original manufacture Settings.
All values of parameters will be equalized to manufacture settings after „Save parameters ”, switch-off and secondary switch-on of power supply to the servo drive.

P1-18 ●	MTR	Motor type	MODBUS Address **0314H**

Setting: 0 Additional description:
Applicable control mode: Pt,Pr,S, T
Dimension:
Range: 0 to 3
Adjustments: this parameter is used to set the type of the controlled motor:
0 - PMSM motor (brushless synchronous motor)
1 - DC motor (Direct current motor мотор with permanent magnets)
2 - reserved
3 - reserved

Group 2: P2-xx Extended parameters

P2-00	DRT	Filter on digital inputs	MODBUS Address **0313H**

Setting: 3.600 Additional description:
Applicable control mode: Pt,Pr,S, T
Dimension: ms
Range: 0 to 20.000
Description: This parameter is used to filtrate the input signals form electromagnetic noise in the environment, caused from power circuits switch-on, contractors and other devices, which can emit electrical disturbances and can cause wrong switch-on at digital inputs of the servo drive. Increasing the value (time constant of the filter) increases the reliability. Higher values can decrease the input fastness.

P2-01 •	DIN1	Input function on terminal IN1 - CN3.17	MODBUS Address **0319H**

Setting: 101 Additional description:
Applicable control mode: Pt,Pr,S, T Table 3.B
Dimension:
Range: 0 to 133
Description: This parameter sets the function and polarity on digital input IN1 – CN3.17.

NOTE

Input function have two addresses to change their condition:

- By digital inputs on servo drive (P2-01 to P2-07, P2-11, P2-14).
- By serial interface (see P2-44 to P2-46)

To choose input functions on P2-01 ~ P2-07, please refer Table 3.B.
The chosen function is valid after its saving in energy independent memory „Flash".

P2-02 •	DIN2	Input function on terminal IN2 - CN3.18	MODBUS Address **031AH**

Setting: 106 Additional description:
Applicable control mode: Pt,Pr,S, T Table 3.B
Range: 0 to 133
Adjustments: See the Note at P2-01 for explanation

P2-03 •	DIN3	Input function on terminal IN3 - CN3.5	MODBUS Address **031BH**

Setting: 21 Additional description:
Applicable control mode: Pt,Pr,S, T Table 3.B
Range: 0 to 133
Adjustments: See the Note at P2-01 for explanation

P2-04 •	DIN4	Input function on terminal IN4 - CN3.3	MODBUS Address **031CH**

Setting: 21 Additional description:
Applicable control mode: Pt,Pr,S, T Table 3.B
Range: 0 to 133
Adjustments: See the Note at P2-01 for explanation

P2-05 •	DIN5	Input function on terminal IN5 - CN3.15	MODBUS Address **031EH**

Setting: 13 Additional description:
Applicable control mode: Pt,Pr,S, T Table 3.B
Range: 0 to 133
Adjustments: See the Note at P2-01 for explanation

P2-06 •	DIN6	Input function on terminal IN6 - CN3.22	MODBUS Address **0329H**

Setting: 0 Additional description:
Applicable control mode: Pt,Pr,S, T Table 3.B
Range: 0 to 133
Adjustments: See the Note at P2-01 for explanation

NOTE

P2-06 and P2-07 must be 0 , by chosen position control mode from external reference (P1-00 = 0)

P2-07 •	DIN7	Input function on terminal IN7 - CN3.20	MODBUS Address **032FH**

Setting: 0
Applicable control mode: Pt,Pr,S, T
Range: 0 to 133
Adjustments: See the Note at P2-01 for explanation

Additional description:
Table 3.B

NOTE

P2-06 and P2-07 must be 0 , by chosen position control mode from external reference (P1-00 = 0)

P2-08 •	DOUT1	OUT1-CN3.16	MODBUS Address **0338H**

Setting: 101
Applicable control mode: Pt,Pr,S, T
Dimension:
Range: 0 to 133
Description: This parameter sets the function and polarity of digital output OUT1 – CN3.16.

Additional description:
Table 3.C

NOTE

For adjustment of output functions on P2-08 to P2-10, please, refer to Table 3.C. The chosen function is valid after its saving in energy independent memory „Flash".

P2-09 •	DOUT2	Output function on terminal OUT2 - CN3.2	MODBUS Address **0339H**

Setting: 107
Applicable control mode: Pt,Pr,S, T
Range: 0 to 133
Adjustments: See the Note at P2-08 for explanation

Additional description:
Table 3.C

P2-10 •	DOUT3	Output function on terminal OUT3 - CN3.1	MODBUS Address **033AH**

Setting: 105
Applicable control mode: Pt,Pr,S, T
Range: 0 to 133
Adjustments: See the Note at P2-08 for explanation

Additional description:
Table 3.C

P2-11 •	AIN1	Function on analog input 1 (V-REF) - CN3.9	MODBUS Address **0336H**

Setting: 1
Applicable control mode: Pt,Pr,S, T
Range: 0 to 3 (when used to set analog function)
1000 to 1133 (when used to set digital function)
Adjustments: This parameter is used to define function on analog input (V-REF).
First digit of the value defines function type:

Additional description:
Table 3.D, Table 3.B

Analog functions - 0xxx
- 0000 – not used
- 0001 – Speed reference
- 0002 – Position reference in Step function

Digital functions - 1xxx
- 1xxx – refer to DIN code in Table 3.B DI signals

For example to assign function SON to analog input 1 set P2-11 = 1n01, where n is 0 or 1 depending on polarity of input signal.
The chosen function is valid after saving in energy independent memory „Flash".

P2-12	A1LV	Analog input 1 threshold (V-REF) - CN3.9	MODBUS Address **0334H**

Setting: 4,800
Applicable control mode: Pt,Pr,S, T
Dimension: V
Range: 0 to 10,000
Description: This parameter is used, when analog input executes function on digital inputs. When parameter P2-11 is set like digital input (1xxx), the value of P2-12 is used to set the level of logical 0 or 1.

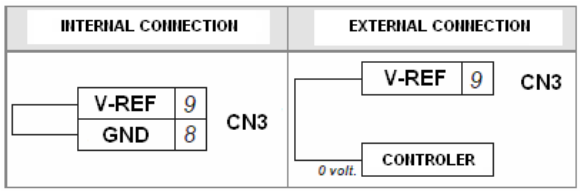
Additional description:

P2-13	A1OF	Offset on analog input 1 (V-REF) - CN3.9	MODBUS Address **0307H**

Setting: 0.000 Additional description:
Applicable control mode: Pt,Pr,S, T
Dimension: V
Range: -10.000 to 10.000
Description: This parameter is used to null manually the offset on the analog input 1.

NOTE

Before start adjustment, make short the internal connection or connect to 0V on external controller, as shown on the figure below.



P2-14 •	AIN2	Function on analog input 2 (T-REF) - CN3.6	MODBUS Address **0337H**

Setting: 1 Additional description:
Applicable control mode: Pt,Pr,S, T Table 3.D, Table 3.B
Range: 0 to 3 (when used for setting analog function)
1000 to 1133 (when used for setting digital function)
Description: This parameter is used to null manually to define function on analog input 2 (T-REF).
The first digit of the value defines the type of the function:

Analog functions - 0xxx
- 0000 – not used
- 0001 – Torque reference
- 0002 – Position reference by using function ”Step performance”
- 0003 – Speed feedback from tachogenerator

Digital functions - 1xxx
- 1xxx – refer to DIN code in Table 3.B

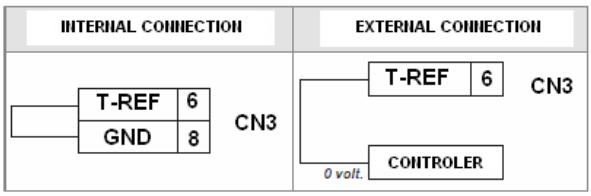
For example to assign function SON to analog input 2 set P2-14 = 1n01, where n is 0 or 1 depending on polarity of the input signal.
The chosen function is valid after saving in energy independent memory „Flash”.

P2-15	A2OF	Offset on analog input 2 (T-REF) - CN3.6	MODBUS Address **0316H**

Setting: 0.000 Additional description:
Applicable control mode: Pt,Pr,S, T
Dimension: V
Range: -10.000 to 10.000
Description: This parameter is used to null manually the offset on analog input 2.

NOTE

Before start adjustment, make short the internal connection or connect to 0V on external controller, as shown on the figure below.



P2-16	A2LV	Analog input 2 threshold (T-REF) - CN3.6	MODBUS Address **0335H**

Setting: 4,800 Additional description:
Applicable control mode: Pt,Pr,S, T
Dimension: V
Range: 0 to 10.000
Description: This parameter is used, when the analog input executes function on digital inputs. When parameter P2-14 e set as digital input (1xxx), the value of P2-16 is used to set the level of logical 0 or 1.

P2-17	A1M	Analog input 1 multiplier (V-REF)- CN3.9	MODBUS Address **035AH**

Setting: 1,000 Additional description:
Applicable control mode: Pt,Pr,S, T
Dimension:
Range: -7,999 to 7,999
Description: This parameter is used to scale the value of signal supplied on analog input 1 (V-REF)- CN3.9
For example if P2-17 = 0.500 and input signal is 2.500V, than the value before converting in analog to digital converter ADC is accepted as 0.500 * 2.500V = 1.250V

P2-18	A2M	Analog input 2 multiplier(T-REF)- CN3.6	MODBUS Address **035BH**

Setting: 1,000 Additional description:
Applicable control mode: Pt,Pr,S, T
Dimension:
Range: -7,999 to 7,999
Description: This parameter is used to scale the value of signal supplied on analog input 2 (T-REF)- CN3.6
For example if P2-18 = -1.500 and input signal is +2.000V, than the value before converting in analog to digital converter ADC is accepted as -1.500 * 2.000V = -3.000V.

P2-19		Reserved	MODBUS Address

P2-20 •	SPD1	1st reference/limit of the speed	MODBUS Address **033BH**

Setting: 100 Additional description:
Applicable control mode: Pr,S, T Chapters 5 , 6
Dimension: RPM
Range: -6000 до 6000
Description: This parameter is chosen from condition of 3 input functions (SC2, SC1,SC0) – 0,0,1
In operation modes **Pr,S,Sz** with internal reference, this parameter sets first speed.
In operation mode **T**, P2-20 sets the first speed limit.

P2-21 •	SPD2	2nd reference/limit of the speed	MODBUS Address **033CH**

Setting: 200 Additional description:
Applicable control mode: Pr,S, T Chapters 5 , 6
Dimension: RPM
Range: -6000 до 6000
Description: This parameter is chosen from condition of 3 input functions (SC2, SC1,SC0) – 0,1,0
In operation modes **Pr,S,Sz** with internal reference, this parameter sets second speed.
In operation mode **T**, P2-21 sets the second speed limit.

P2-22 •	SPD3	3rd reference/limit of the speed	MODBUS Address **033DH**

Setting: 300 Additional description:
Applicable control mode: Pr,S, T Chapters 5 , 6
Dimension: RPM
Range: -6000 до 6000
Description: This parameter is chosen from condition of 3 input functions (SC2, SC1,SC0) – 0,1,1
In operation modes **Pr,S,Sz** with internal reference, this parameter sets third speed.
In operation mode **T**, P2-22 sets the third speed limit.

P2-23 •	SPD4	4th reference/limit of the speed	MODBUS Address **033EH**

Setting: 400 Additional description:
Applicable control mode: Pr,S, T Chapters 5 , 6
Dimension: RPM
Range: -6000 до 6000
Description: This parameter is chosen from condition of 3 input functions (SC2, SC1,SC0) – 1,0,0
In operation modes **Pr,S,Sz** with internal reference, this parameter sets fourth speed.
In operation mode **T**, P2-23 sets the fourth speed limit.

P2-24 ●	SPD5	5th reference/limit of the speed	MODBUS Address **033FH**

Setting: -400 Additional description:
Applicable control mode: Pr,S, T Chapters 5 , 6
Dimension: RPM
Range: -6000 до 6000
Description: This parameter is chosen from condition of 3 input functions (SC2, SC1,SC0) – 1,0,1
In operation modes **Pr,S,Sz** with internal reference, this parameter sets fifth speed.
In operation mode **T**, P2-24 sets the fifth speed limit.

P2-25 ●	SPD6	6th reference/limit of the speed	MODBUS Address **0340H**

Setting: -1000 Additional description:
Applicable control mode: Pr,S, T Chapters 5 , 6
Dimension: RPM
Range: -6000 до 6000
Description: This parameter is chosen from condition of 3 input functions (SC2, SC1,SC0) – 1,1,0
In operation modes **Pr,S,Sz** with internal reference, this parameter sets sixth speed.
In operation mode **T**, P2-25 sets the sixth speed limit.

P2-26 ●	SPD7	7th reference/limit of the speed	MODBUS Address **0341H**

Setting: -1500 Additional description:
Applicable control mode: Pr,S, T Chapters 5 , 6
Dimension: RPM
Range: -6000 до 6000
Description: This parameter is chosen from condition of 3 input functions (SC2, SC1,SC0) – 1,1,1
In operation modes **Pr,S,Sz** with internal reference, this parameter sets seventh speed.
In operation mode **T**, P2-26 sets the seventh speed limit.

P2-27 ■	SPDM	Speed reference/limit by serial interface (MODBUS protocol)	MODBUS Address **0210H**

Setting: Additional description:
Applicable control mode: S, T Chapters 5 , 6 , 8
Dimension: RPM
Range: -6000 до 6000
Description: It is used like register of speed reference by serial channel (MODBUS).
The reference is valid if:

- the 3 input functions (SC2, SC1,SC0) = 0,0,0 ;
- the function of analog input 1 (P2-11) = 0 ;

In operation control modes **S, Sz**, the value of this parameter is speed reference.
In torque control mode **T**, the value of P2-27 is speed limit.

P2-28 ●	TRQ1	1st reference/limit of the torque (current)	MODBUS Address **0342H**

Setting: 0.200 Additional description:
Applicable control mode: Pt,Pr,S, T Chapters 5 , 6
Dimension: A
Range: 0 to P3-02(SCL)
Description: This parameter is chosen from condition of 3 input functions (TC2, TC1,TC0) – 0,0,1
In operation modes **Pr,Pt,S,Sz** the value of P2-28 is the first torque (current) limit.
In torque control modes **T**, **Tz** this parameter is the first torque reference.

P2-29 ●	TRQ2	2nd reference/limit of the torque (current)	MODBUS Address **0343H**

Setting: 0.400 Additional description:
Applicable control mode: Pt,Pr,S, T Chapters 5 , 6
Dimension: A
Range: 0 to P3-02(SCL)
Description: This parameter is chosen from condition of 3 input functions (TC2, TC1,TC0) – 0,1,0
In operation modes **Pr,Pt,S,Sz** the value of P2-29 is the second torque (current) limit.
In torque control modes **T**, **Tz** this parameter is the second torque reference.

P2-30 ●	TRQ3	3rd reference/limit of the torque (current)	MODBUS Address **0344H**

Setting: 0.600
Applicable control mode: Pt,Pr,S, T
Dimension: A
Range: 0 to P3-02(SCL)
Description: This parameter is chosen from condition of 3 input functions (TC2, TC1,TC0) – 0,1,1
In operation modes **Pr,Pt,S,Sz** the value of P2-30 is the third torque (current) limit.
In torque control modes **T**, **Tz** this parameter is the third torque reference.
Additional description:
Chapters 5 , 6

P2-31 ●	TRQ4	4th reference/limit of the torque (current)	MODBUS Address **0345H**

Setting: 0.800
Applicable control mode: Pt,Pr,S, T
Dimension: A
Range: 0 to P3-02(SCL)
Description: This parameter is chosen from condition of 3 input functions (TC2, TC1,TC0) – 1,0,0
In operation modes **Pr,Pt,S,Sz** the value of P2-31 is the fourth torque (current) limit.
In torque control modes **T**, **Tz** this parameter is the fourth torque reference.
Additional description:
Chapters 5 , 6

P2-32 ●	TRQ5	5th reference/limit of the torque (current)	MODBUS Address **0346H**

Setting: 1.000
Applicable control mode: Pt,Pr,S, T
Dimension: A
Range: 0 to P3-02(SCL)
Description: This parameter is chosen from condition of 3 input functions (TC2, TC1,TC0) – 1,0,1
In operation modes **Pr,Pt,S,Sz** the value of P2-32 is the fifth torque (current) limit.
In torque control modes **T**, **Tz** this parameter is the fifth torque reference.
Additional description:
Chapters 5 , 6

P2-33 ●	TRQ6	6th reference/limit of the torque (current)	MODBUS Address **0347H**

Setting: 1.200
Applicable control mode: Pt,Pr,S, T
Dimension: A
Range: 0 to P3-02(SCL)
Description: This parameter is chosen from condition of 3 input functions (TC2, TC1,TC0) – 1,1,0
In operation modes **Pr,Pt,S,Sz** the value of P2-33 is the sixth torque (current) limit.
In torque control modes **T**, **Tz** this parameter is the sixth torque reference.
Additional description:
Chapters 5 , 6

P2-34 ●	TRQ7	7th reference/limit of the torque (current)	MODBUS Address **0348H**

Setting: 1.400
Applicable control mode: Pt,Pr,S, T
Dimension: A
Range: 0 to P3-02(SCL)
Description: This parameter is chosen from condition of 3 input functions (TC2, TC1,TC0) – 1,1,1
In operation modes **Pr,Pt,S,Sz** the value of P2-34 is the seventh torque (current) limit.
In torque control modes **T**, **Tz** this parameter is the seventh torque reference.
Additional description:
Chapters 5 , 6

P2-35 ■	TRQM	Torque (current) reference/limit by serial interface (MODBUS protocol))	MODBUS Address **02XXH**

Setting:
Applicable control mode: Pt,Pr,S,T
Dimension: A
Range: 0 to P3-02(SCL)
Description: It is used like register of torque (current) reference by serial channel (MODBUS).
The reference is valid if:

- the 3 input functions (TC2, TC1,TC0) = 0,0,0 ;
- the function of analog input 2 (P2-14) = 0 ;

In operation control modes **Pr, Pt, S, Sz**, the value of P2-35 is seventh torque (current) limit.
In torque control mode **T**, **Tz** the value of this parameter is seventh torque reference.
Additional description:
Chapters 5 , 6

P2-36 • POS1 | 1st position reference (32 bit) | MODBUS Address **0349H**

Setting: 0
Applicable control mode: Pr
Dimension: pulse
Range: - 2147483647 to 2147483648
Description: This parameter is chosen from condition of 3 input functions (PC2, PC1,PC0) – 0,0,1
In position control mode **Pr** this parameter is the first internal position reference.
Speed reference for positioning is from P2-20 (SPD1).

Additional description:
Chapters 5 , 6

P2-37 • POS2 | 2nd position reference (32 bit) | MODBUS Address **034BH**

Setting: 10000
Applicable control mode: Pr
Dimension: pulse
Range: - 2147483647 to 2147483648
Description: This parameter is chosen from condition of 3 input functions (PC2, PC1,PC0) – 0,1,0
In position control mode **Pr** this parameter is the second internal position reference.
Speed reference for positioning is from P2-21 (SPD2).

Additional description:
Chapters 5 , 6

P2-38 • POS3 | 3rd position reference (32 bit) | MODBUS Address **34DH**

Setting: 20000
Applicable control mode: Pr
Dimension: pulse
Range: - 2147483647 to 2147483648
Description: This parameter is chosen from condition of 3 input functions (PC2, PC1,PC0) – 0,1,1
In position control mode **Pr** this parameter is the third internal position reference.
Speed reference for positioning is from P2-22 (SPD3).

Additional description:
Chapters 5 , 6

P2-39 • POS4 | 4th position reference (32 bit) | MODBUS Address **034FH**

Setting: 30000
Applicable control mode: Pr
Dimension: pulse
Range: - 2147483647 to 2147483648
Description: This parameter is chosen from condition of 3 input functions (PC2, PC1,PC0) – 1,0,0
In position control mode **Pr** this parameter is the fourth internal position reference.
Speed reference for positioning is from P2-23 (SPD4).

Additional description:
Chapters 5 , 6

P2-40 • POS5 | 5th position reference (32 bit) | MODBUS Address **0351H**

Setting: 40000
Applicable control mode: Pr
Dimension: pulse
Range: - 2147483647 to 2147483648
Description: This parameter is chosen from condition of 3 input functions (PC2, PC1,PC0) – 1,0,1
In position control mode **Pr** this parameter is the fifth internal position reference.
Speed reference for positioning is from P2-24 (SPD5).

Additional description:
Chapters 5 , 6

P2-41 • POS6 | 6th position reference (32 bit) | MODBUS Address **0353H**

Setting: -20000
Applicable control mode: Pr
Dimension: pulse
Range: - 2147483647 to 2147483648
Description: This parameter is chosen from condition of 3 input functions (PC2, PC1,PC0) – 1,1,0
In position control mode **Pr** this parameter is the sixth internal position reference.
Speed reference for positioning is from P2-25 (SPD6).

Additional description:
Chapters 5 , 6

P2-42 • POS7 | 7th position reference (32 bit) | MODBUS Address **0355H**

Setting: -10000
Applicable control mode: Pr
Range: - 2147483647 to 2147483648
Description: This parameter is chosen from condition of 3 input functions (PC2, PC1,PC0) – 1,1,1
In position control mode **Pr** this parameter is the seventh internal position reference.
Speed reference for positioning is from P2-26 (SPD7).

Additional description:
Chapters 5 , 6

P2-43 ■	POSM	Position reference (32 bit) by serial interface (MODBUS protocol)	MODBUS Address **0384H**

Setting:
Applicable control mode: Pr
Dimension: pulse
Range: - 2147483647 to 2147483648
Description:
It is used like register of position reference by serial communication interface (MODBUS)
The reference is valid if;

- the 3 input functions (PC2, PC1,PC0) = 0,0,0 ;

The speed reference by positioning is from P1-11 (PSPD).

Additional description:
Chapters 5 , 6

P2-44 ■	SI0	Register reference input functions 0 by serial interface (MODBUS protocol)	MODBUS Address **0398H**

Setting:
Applicable control mode: Pt,Pr,S,T
Dimension: bit addressing
Range: 1 to 3FFF
Description: Input functions have two addresses to change their condition:

- By digital inputs of servo drive (see P2-01 to P2-07, P2-11, P2-14)
- By serial interface

This parameter serves for by-bit choosing of condition on input functions 0, by means of serial interface (MODBUS protocol).
When corresponding bit is activated (logical 1), it means:

Bit 0 = **SON** Permission to operate – Servo On
Bit 1 = **ARST** Alarm reset
Bit 2 not used
Bit 3 = **CCLR** Clear register of position deviation in position control mode Pt
Bit 4 = **ZCLM** Function „Zero clamp zone" is active
Bit 5 = **CMDINV** Function „Inverting reference" is active
Bit 6 = **INHP** position reference in mode Pt is not valid
Bit 7 = **STEP** Function „Step performance" is active
Bit 8 not used
Bit 9 = **GNM** Selected electronic gear with ratio – from parameter B2M
Bit 10 = **SPD0** Zero bit of speed reference from parameter is active
Bit 11 = **SPD1** First bit of speed reference from parameter is active
Bit 12 = **SPD2** Second bit of speed reference from parameter is active
Bit 13 = **EMGS** Emergency stop active
Bit 14 and Bit 15 not used

Additional description:
Table 3.B in Chapter 3

P2-45 ■	SI1	Register reference input functions 1 by serial interface (MODBUS protocol)	MODBUS Address **0399H**

Setting:
Applicable control mode: Pt,Pr,S,T
Dimension: bit addressing
Range: 1 to 3FFF
Description: Input functions have two addresses to change their condition:

- By digital inputs of servo drive (see P2-01 to P2-07, P2-11, P2-14)
- By serial interface

This parameter serves for by-bit choosing of condition on input functions 1, by means of serial interface (MODBUS protocol).
When corresponding bit is activated (logical 1), it means:

Bit 0 = **TC0** Zero bit of torque reference from parameter is active
Bit 1 = **TC1** First bit of torque reference from parameter is active
Bit 2 = **TC2** Second bit of torque reference from parameter is active
Bit 3 = **SW-Pt** Chosen position control mode Pt
Bit 4 = **SW-Pr** Chosen position control mode Pr
Bit 5 = **SW-S** Chosen speed control S
Bit 6 = **CWL** Reference for negative speed (clockwise direction) forbidden
Bit 7 = **CCWL** Reference for positive speed (counter clockwise direction) forbidden

Additional description:
Table 3.B in Chapter 3

Bit 8 = **PC0** Zero bit of position reference by parameter is active
Bit 9 = **PC1** First bit of position reference by parameter is active
Bit 10 = **PC2** Second bit of position reference by parameter is active
Bit 11 = **DEC** Referenced low speed for zero return position (deceleration switch)
Bit 12 = **ZRNST** Function „Finding zero return point" is started
Bit 13 = **RFST** Reference point is set
Bit 14 to Bit 15 not used

P2-46 ■	SI2	Register reference input functions 2 by serial interface (MODBUS protocol)	MODBUS Address **039AH**

Setting: Additional description:
Applicable control mode: Pt,Pr,S,T Table 3.B in Chapter 3
Dimension: bit addressing
Range: 1 to 3FFF
Description: Input functions have two addresses to change their condition:

- By digital inputs of servo drive (see P2-01 to P2-07, P2-11, P2-14)
- By serial interface

This parameter serves for by-bit choosing of condition on input functions 2, by means of serial interface (MODBUS protocol).
When corresponding bit is activated (logical 1), it means:
Bit 0 = **JOG +** Positive speed of rotation referenced (from parameter PSPD)
Bit 1 = **JOG -** Positive speed of rotation referenced (from parameter PSPD)
Bit 2 to Bit 15 not used

P2-47		Not used	MODBUS Address

P2-48		Not used	MODBUS Address

P2-49	ZSP	Zero speed threshold „ZSPD" output	MODBUS Address **035CH**

Setting: 10,000 Additional description:
Applicable control mode: Pt,Pr,S,T Table 3.B (ZSPD), Chapter.3
Dimension: RPM
Range: 0 to 200.000
Description: Defines threshold condition of output function "Zero speed". Output „ZSPD" is activated, when the motor speed is equal or lower than the value, defined in this parameter.

P2-50	TSP	Threshold speed of rotation „TSPD" output	MODBUS Address **035DH**

Setting: 500,000 Additional description:
Applicable control mode: Pt,Pr,S,T Table 3.B (TSPD), Chapter 3
Dimension: RPM
Range: 0 to 6000
Description: Defines threshold condition of output function "Speed arrival". Output „TSPD" is activated, when the motor speed is equal or higher than the value, defined in this parameter.

P2-51	TCR	Threshold motor current „TCUR" output	MODBUS Address **0325H**

Setting: 1.100 Additional description:
Applicable control mode: Pt,Pr,S,T Table 3.B (TCUR), Chapter 3
Dimension: A
Range: 0 to P3-02 (SCL)
Description: Defines threshold condition of output function "Reached current". Output „TCUR" is activated, when the current (proportional to the torque) is equal or higher than the value, defined in this parameter.

Group 3: **P3-xx Parameters Limits**

P3-00	HSR	Current range	MODBUS Address **0309H**

Setting: 19.500 Additional description:
Applicable control mode: Pt,Pr,S,T Chapter 10
Dimension: A
Range: 5 to 150
Description: This parameter defines the range of measured currents and connected with them parameters and values.

NOTE

The parameter is adjusted by the manufacturer and corresponds on the range of the built-in the servo drive Hall sensors. Its change can bring the servo drive to damage.

P3-01	IPM	Current threshold of protection „Over current"	MODBUS Address **0311H**

Setting: 15.000 Additional description:
Applicable control mode: Pt,Pr,S,T Chapter 10
Dimension: A
Range: 0 to 150
Description: This parameter defines the maximal output current for protection "Over current" of the servo drive.

NOTE

The parameter is adjusted by the manufacturer and corresponds to the maximal current of the built-in IGBT power block. Its change from the customer can cause a damage of the servo drive.

P3-02	SCL	Maximal current limit	MODBUS Адрес **030EH**

Setting: 12.000 Additional description:
Applicable control mode: Pt,Pr,S,T Chapter 10
Dimension: A
Range: 0 to 150
Description: This parameter defines the maximal allowed output current for normal operation of the servo drive. Its value must correspond to the maximal current of the motor.

P3-03	CL2	300% x Nominal current of the motor for protection "Overload"	MODBUS Address **0318H**

Setting: 12.000 Additional description:
Applicable control mode: Pt,Pr,S,T Chapter 11
Dimension: A
Range: 0 to 150
Description: This parameter is used for adjustment of 300% nominal current of the motor. This parameter defines the final point of overloading characteristics, chosen in P3-05.

P3-04	CL1	120% x Nominal current of the motor for protection "Overload"	MODBUS Address **030FH**

Setting: 12.000 Additional description:
Applicable control mode: Pt,Pr,S,T Chapter 11
Dimension: A
Range: 0 to 150
Description: This parameter is used for adjustment of 120% nominal current of the motor. This parameter defines the starting point of overloading characteristics, chosen in P3-05.

P3-05	OVL	Type of the motor overload characteristic	MODBUS Address **0310H**

Setting: 0 Additional description:
Applicable control mode: Pt,Pr,S,T Chapter 11
Dimension:
Range: 0 to 15

Description: This parameter defines the type of current overload characteristic of the used motor (examined in details in Chapter 11). The user is obliged to use the nearest by technical data curve or with changes of P3-04 and P3-05 to get maximal close to it.

P3-06	VCC	DC voltage calibration	MODBUS Address **0317H**

Setting: 1.000 Additional description:
Applicable control mode: Pt,Pr,S,T
Dimension:
Range: 0.001 to 1.999
Description: This parameter is used for value calibration of PO-16. The calibration is made by the manufacturer.

P3-07	VHL	Voltage threshold protection "Over voltage"	MODBUS Address **0320H**

Setting: 390.00 Additional description:
Applicable control mode: Pt,Pr,S,T
Dimension: V
Range: 0 to 1000.00
Description: This parameter defines the maximal DC voltage for normal operation of servo drive.

P3-08	VLL	Voltage threshold of protection "Low voltage"	MODBUS Address **0321H**

Setting: 70.000 Additional description:
Applicable control mode: Pt,Pr,S,T
Dimension: V
Range: 0 to 1000.00
Description: This parameter defines the minimal allowed DC voltage for normal operation of servo drive. The customer can ignore this protection, if the value = 0.

P3-09	BRL	Voltage threshold break resistor switch-on	MODBUS Address **0322H**

Setting: 360.00 Additional description:
Applicable control mode: Pt,Pr,S,T
Dimension: V
Range: 0 to 1000.00
Description: In generating mode of operation or by stop, depending on the inertia mass of the mechanical system, the voltage on the DC buss is increasing. It leads to decrease of the control fastness. This parameter defines the value of voltage, by which the break (extinguish) resistor will switch-on for correct operation of the servo drive. In most cases it is necessary this parameter to be around 10 – 15% lower than P3-07 (VHL) and with 20% higher than running value of P0-16 (DCM).

P3-10	THL	Threshold of protection „Overheating of servo drive"	MODBUS Address **0323H**

Setting: 95 Additional description:
Applicable control mode: Pt,Pr,S,T
Dimension: °C
Range: 0 to 150.00
Description: This parameter defines the maximal temperature for normal operation of the servo drive.

P3-11	ARM	Register mask of alarms	MODBUS Address **0312H**

Setting: 2BFF Additional description:
Applicable control mode: Pt,Pr,S,T
Dimension: bit addressing
Range: 1to FFFF
Description: This parameter is used about bit masking (covering) of the alarms from P0-01 (ALE). By registering of what ever alarm from P0-01 (ALE) and corresponding bit in this parameter is **1,** the motor will stop and will be activated output function «ALM" (failure). Otherwise if the corresponding bit is **0,** the servo drive will continue to operate, but will be activated output function „WARN" (warning).

NOTE

This parameter is used by diagnostic and service of the servo drive. It is adjusted by the manufacturer and it is not recommended its change by the user.

Chapter 4: P4-xx Parameters communication

P4-00	ADR	MODBUS address of servo drive	MODBUS Address **0327H**

Setting: 04 Additional description:
Applicable control mode: Pt,Pr,S,T
Dimension: not announced
Range: 1 to 255
Adjustments:
If servo drive is controlled from RS-485 communication, each drive must be identified separately and must be addressed between 1 and 254. The admission for programming is this parameter.

P4-01	SCI	Communication Settings	MODBUS Address **0357H**

Setting: 03 Additional description:
Applicable control mode: Pt,Pr,S,T Chapter 8
Dimension:
Range: 0 to 23
Adjustments:

Setting	0	0	Y	X
Range	0	0	0 до 2	0 до 3

X – Communication speed Adjustment
0: Speed 19200 bps
1: Speed 38400 bps
2: Speed 57600 bps
3: Speed 115200 bps

Y – Communication protocol
0: Modbus RTU mode, <8,N,2>
1: Modbus RTU mode, <8,E,1>
2: Modbus RTU mode, <8,O,1>

For example when this parameter is 03, it means, that SCI protocol is 115200 <8,N,2>

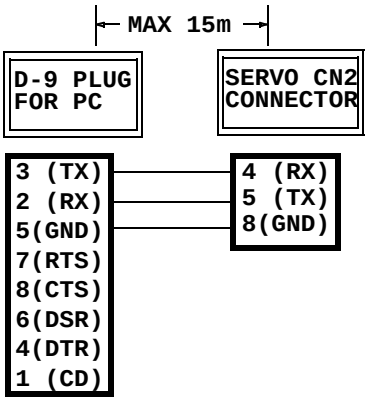
P4-02	CDT	Communication delay	MODBUS Address **0358H**

Setting: 0 Additional description:
Applicable control mode: Pt,Pr,S,T Chapter 8
Dimension: msec
Range: 0 to 20.000
Description: This parameter is used about delay between received package “Request” (external controller) and package “Reply” (from servo drive).

8.1. Communication hardware interface

Series AC servo drives ELAS support two modes of serial interface RS-232 and RS-485/RS422, allowing connection of external devices as controllers (PLC), computers (PC) or panels for control and adjustments. On the basis of these modes is realized standard protocol for series communication MODBUS for control, diagnostics and adjustments of all parameters. To choose the interface (RS-232 or RS-485) serve jumpers JP11 and JP12 (for details see item 3.4. Connectors CN1 and CN2 for series interface, Chapter 3).

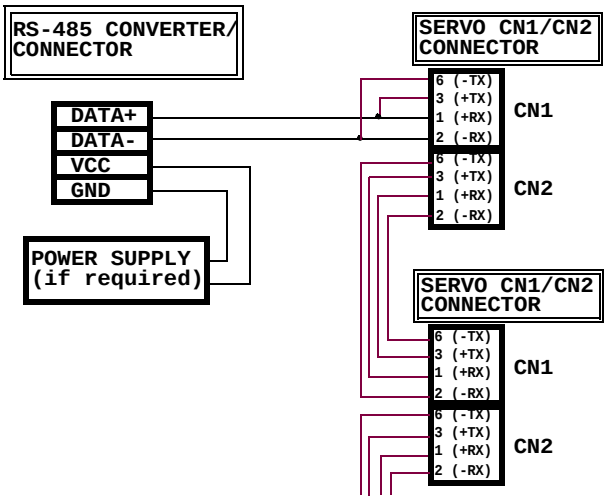
Cable for connection in mode RS-232



NOTE

- For RS-232 connection, it is recommended the maximal length of the cable to be 15m. If the speed of transmission is higher than 38400 bps it is required maximal length of the cable to be 3m.

Cable for connection in mode RS-485 / RS422



NOTE

- For low speeds of communication (up to 38400 bps) in mode RS-485/RS-422, the recommended maximal length of the cable is 100m. If the speed of transmission is higher, it is required maximal length of the cable to be 15m.
- Maximal number of devices in the net is 32.

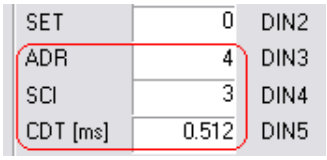
8.2. MODBUS Communication parameter setting

To adjust communication interface of the servo drive the following parameters are used:

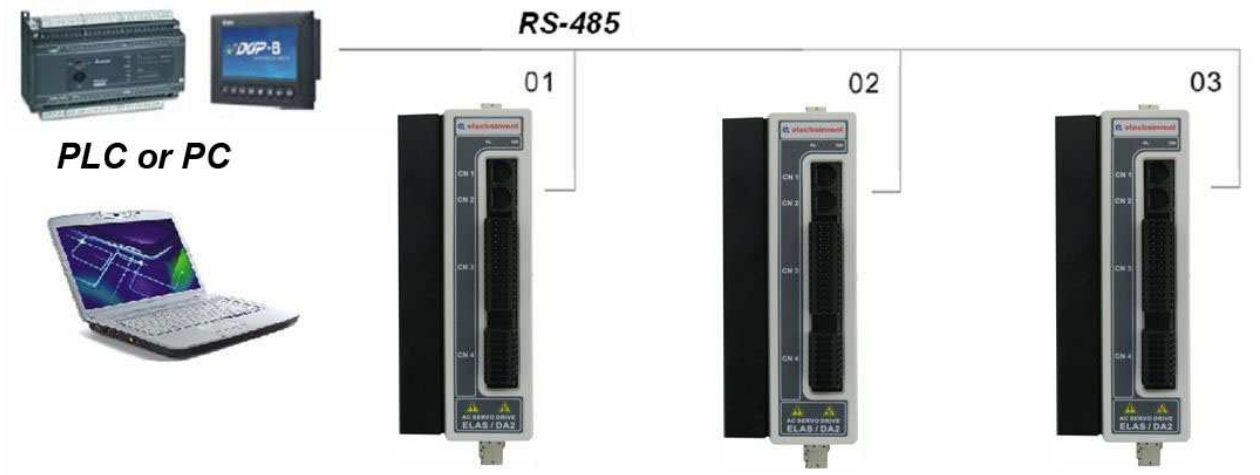
Communication parameters						
Parameter	MODBUS address	Name	Function	Default	Dimension	Control mode
P4-00 ●	0327H	ADR	MODBUS address of servo drive	4	-	Pt,Pr,S,T
P4-01 ●	0357H	SCI	Communication setting	0	-	Pt,Pr,S,T
P4-02	0358H	CDT	Communication delay	0	ms	Pt,Pr,S,T

The parameter description is applied in Chapter 7 in this manual. Here below are described the basic instructions for parameter setting.

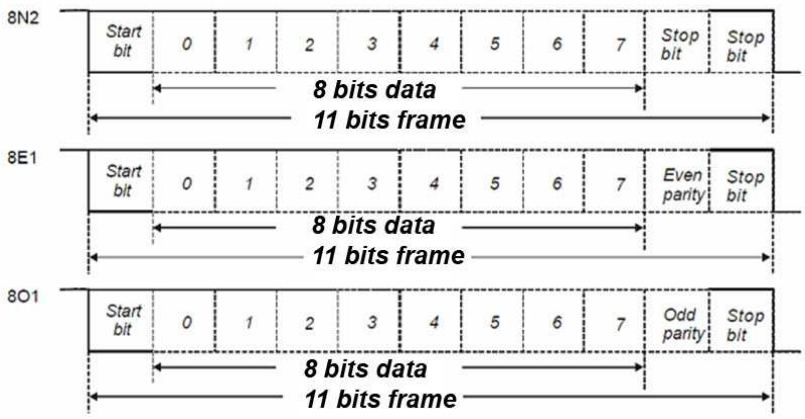
- Choose the communication mode (RS232/RS485) by means of jumpers JP11 and JP12.
- Connect the servo drive to PC and start configuration software DriverCom (for details about operation with the software - refer to Chapter 4).
- In second dialog window of "Modify Parameters", field „Basic parameters" are located three communication parameters.



ADR is absolute address of the servo drive in MODBUS net applications. This parameter identifies each device and it has not to be duplicated with other one in communication net.



SCI defines the type and speed of communication protocol



Setting	0	0	Y	X
Range	0	0	0 ~ 2	0 ~ 3

Y – Protocol for communication
- 0: Modbus RTU mode, <8,N,2>
- 1: Modbus RTU mode, <8,E,1>
- 2: Modbus RTU mode, <8,O,1>

X — Speed of communication
- 0: speed 19200 bps
- 1: speed 38400 bps
- 2: speed 57600 bps
- 3: speed 115200 bps

For example when this parameter is 3, it means that SCI protocol is 115200 <8,N,2>

CDT delays the time, when the servo drive replies to external controller.

8.3. MODBUS communication protocol

Series AC servo drives ELAS support standard protocol MODBUS RTU. The common format of communication packages is as follows:

STX	Pause for beginning of the package
ADR	Address of device: 1 byte
CMD	Command function: 1 byte
DATA(n-1)	Data: n word = n x 2 bytes
…….	
DATA(0)	
Validity check of package CRC	2 bytes
ENDX	Pause for ending of the package

The data format (DATA) depends on command function. Available functions for commands and examples for AC servo drives ELAS are described bellow.

- **Command function (0x03) – Reading of block addresses**

This function is used about reading the contents of in series located addresses in the memory (maximum up to 7) of remote device (in this case the servo drive). External controller (requesting device) defines the starting address, number of consecutive addresses and calculates the valid sum of the packet. The created packet is sent to declared from ADR servo drive. The receiving device (ADR = P4-00) checks the packet about validity and if the check is successful, creates packet "Response", containing number of bytes for access, consecutive contents of declared addresses and calculation of valid sum.

Request message :

ADR	04H
CMD	03H
Starting data Address	03H (Upper bytes) 6FH (Lower bytes)
Number of data (count by word)	00H 02H
CRC Check Low	F4H (Lower bytes)
CRC Check High	07H (Upper bytes)

Response message :

ADR	04H
CMD	03H
Number of data (count by byte)	04H
Contents of Starting Data address 036FH	13H (Upper bytes)
	7DH (Lower bytes)
Contents of Second Data address 0370H	00H (Upper bytes)
	00H (Lower bytes)
CRC Check Low	3BH (Lower bytes)
CRC Check High	AFH (Upper bytes)

NOTE

By error, connected with check-up for validity, packet "Response" is not created. For other errors by communication see "Command function Error" below.

- **Command function (0x06) Writing in single address**

This function is used about writing in single address in the memory of remote device (in this case the servo drive). The requesting device creates packet "Request" containing address and the value to be recorded and calculates the valid sum of the packet. The created packet is sent to declared in ADR servo drive. The receiving device (ADR = P4-00) checks the packet about validity and if the check is successful, writes the contents of corresponding address and returns packet "Response" (echo of the request).

Request message :

ADR	04H
CMD	06H
Starting data Address	03H (Upper bytes) 08H (Lower bytes)
Data to Starting address 0308H	00H 03H
CRC Check Low	48H (Lower bytes)
CRC Check High	18H (Upper bytes)

Response message :

ADR	04H
CMD	06H
Starting data Address	03H (Upper bytes) 08H (Lower bytes)
Contents of data	00H 03H
CRC Check Low	48H (Lower bytes)
CRC Check High	18H (Upper bytes)

NOTE

By error, connected with check-up for validity, packet "Response" is not created. For other errors by communication see "Command function Error" below.

- **Command function (0x10) Writing in block addresses**

This function is used about writing of in series located addresses in the memory (maximum up to 7) of remote device (in this case the servo drive). External controller (requesting device) defines the starting address, number of consecutive addresses (by words and by bytes), consecutive values for writing of consecutive located in the memory addresses and calculates the valid sum of the packet. The created packet is sent to declared from ADR servo drive. The receiving device (ADR = P4-00) checks the packet about validity and if the check is successful, creates packet "Response", containing starting address and number of written addresses (in words) and calculation of valid sum.

Request message :

ADR	04H
CMD	10H
Starting data Address	03H (Upper bytes) 84H (Lower bytes)
Number of data (count by word)	00H 02H
Number of data (count by byte)	04H
Data to Starting address 0384H	E2H (Upper bytes) 40H (Lower bytes)
Data to Second address 0385H	00H (Upper bytes) 01H (Lower bytes)
CRC Check Low	6CH (Lower bytes)
CRC Check High	00H (Upper bytes)

Response message :

ADR	04H
CMD	10H
Starting data Address	03H (Upper bytes) 84H (Lower bytes)
Number of data (count by word)	00H 02H
CRC Check Low	01H (Lower bytes)
CRC Check High	F0H (Upper bytes)

NOTE

By error, connected with check-up for validity, packet "Response" is not created. For other errors by communication see "Command function Error" below.

- **Command function Error (+ 0x80) – Error by communication**

This function is used from responding device (in this case the servo drive) by incorrect packet "Request" from inquiring device side (external controller). In this case the servo drive will create packet "Response" containing code of the error and will add the number 0x80 to command function.

Response message :

ADR	04H
CMD	86H
Error Code	02H
CRC Check Low	D3H (Lower bytes)
CRC Check High	A0H (Upper bytes)

Error Code

Code Error	Error name	Description
0x01	FNC_ERR	Functional error – invalid functional code
0x02	IDX_ERR	Parametric error: Read/Write of non existing parameter
0x03	VAL_ERR	Error reference: the value for writing is out of range (Higher than maximal for adjustment or lower than the minimal one)
0x04	OV_PT	Error Fill-in: The number of the data for reading and writing exceed the maximum
0x05	ZO_PT	Error Null number: The number of the data for reading/writing is 0

An example for generating of valid sum CRC using programming language C. The function accepts two arguments

unsigned char* data;
unsigned char length;

The function returns CRC value as integer without sign

```
unsigned int crc_chk(unsigned char* data, unsigned char length) {
        int j;
        unsigned int reg_crc=0xFFFF;

        while( length-- ) {
                reg_crc^= *data++;
                for (j=0; j<8; j++ ) {
                        if( reg_crc & 0x01 ) { /*LSB(bit 0 ) = 1 */
                                reg_crc = (reg_crc >> 1)^0xA001;
                        } else {
                                reg_crc = (reg_crc>>1);
                        }
                }
        }
        return reg_crc;
}
```

Maintenance

In order to guarantee longer term of exploitation of the AC servo drives ELAS it is recommended periodical check and maintenance.

Attention:

- The maintenance is done by qualified personnel.
- Ensure lasting and visible disconnection from the power supply, check the protective earthing and use protective means.
- Input terminals are under dangerous voltage!

Before each maintenance, always switch-off the supply voltage to the servo drive and wait until full capacitors battery discharge.

9.1. Maintenance – periodicity is defined from the operation conditions

- Use and store the servo drive in proper and normal environment, corresponding to the requirements for transport and storage.
- Periodically clean the surface and panel of servo drive and motor.
- Check about damaged insulation or damage of connecting wires.
- Clean on time from dust and dirt. Stress on cleaning the ventilation holes, located on the upper side of the servo. Always keep these places clean, to avoid damage of the unit.

9.2. Replacement of components

- *Electrolytic capacitors*

The characteristics of smoothing capacitor (electrolytic type) worsen under influence of current ripples. The life of capacitors depends a lot from ambient temperature and operation conditions. The guaranteed life of smooth capacitor is ten years when it is properly used in normal air-conditioned environment.

- *Relay*

The contacts of power relay will wear after a time and it will increase the contact resistance. In some cases it will cause welding of the contacts or vice verse - the charging resistor is not shortened and as a result appear an error “Low voltage”. The working life of the relay depends on the number of switching-on. As a whole, there are guaranteed 100'000 cycles switch-on/switch-off.

- *Cooling fan*

The cooling fan life is limited and should be checked and changed periodically. The cooling fan will reach the end of its life in 2~3 years by continuous operation. However, it also must be replaced if vibration or unusual noise appear.

Troubleshooting

Registration of alarm in servo drive is accompanying with stop of servo drive control, activating of output function “ALARM” (ALM) and red LED AL.
Reading of alarm condition of the servo drive is realized with software packet DriverCom – main dialog window, field **Errors**.

10.1. Table of alarms (P0-01 - ALE)

Alarm Messages		
Error name	**Error description**	**MODBUS Address bit**
Absolute encoder U/V/W disconnect	Error of absolute position signals U,V,W	0300H.0
Incremental encoder A/B/C disconnect	Error of encoder signals A,B,C	0300H.1
Motor overload	Motor overload	0300H.2
Driver overheat	Servo drive overheating	0300H.3
Undervoltage	Under voltage in DC part	0300H.4
Overvoltage	Over voltage in DC part	0300H.5
Overcurrent	Over current – current overload	0300H.6
IPM fault	Error in IGBT power module	0300H.7
Brake resistor overload	Overload of break resistor	0300H.8
Position error	Error of position reference	0300H.9
MODBUS communication timeout	Communication error	0300H.10
Analog command error	Error from analog to digital converter ADC	0300H.11
EMGS Emergency stop	Emergency stop activated	0300H.12
Dsp Error	Error in main processor	0300H.13
Current limit active	Current limitation activated	0300H.14
Speed limit active	Speed limitation activated	0300H.15

10.2. Potential cause and corrective actions to eliminate the alarms

Error of absolute position signals U,V,W		
Cause	**Checking method**	**Corrective actions**
Disconnection, short circuit or wrong wiring of feedback signal cable	1. Check the feedback cable about correct wiring CN4 – encoder (see Chapter 3, 3.4). 2. Check if the encoder type corresponds to the assigned in **P1-16 (ENT)**. 3. Check about damages.	The alarm can be cleared (reset) with the help of **SON** or **ARST** (see Chapter 3, Table 3.B). If after the checking, the alarm doesn't clear, please, consult with your supplier or with “Electroinvent” Ltd.
Damaged encoder	Check the encoder	
Electromagnetic disturbances in feedback cable	1. Check servo motor about correct earthing. 2. Check if feedback cable is placed in a conduit, separately from power cables to L1,L2,L3 and U, V, W. 3. Check if the cable is shielded.	
Control mode **P1-00**	Check if the servo drive is in control mode **P1-00 (CTM) = 5** (Automatic adjustment of absolute position). If the checking is right, change 2 of power cables to the motor (for example U - V). Start again function Finding absolute position.	

Error of incremental encoder signals A,B,C		
Cause	**Checking method**	**Corrective actions**
Disconnection, short circuit or wrong wiring of feedback signal cable	1. Check the feedback cable about correct wiring CN4 – encoder (see Chapter 3, item 3.4). 2. Check about damages.	The alarm can be cleared (reset) with the help of **SON** or **ARST** (see Chapter 3, Table 3.B). If after the checking, the alarm doesn't clear, please, consult with your supplier or with "Electroinvent" Ltd.
Electromagnetic disturbances in feedback cable	1. Check servo motor about correct earthing. 2. Check if feedback cable is placed in a conduit, separately from power cables to L1, L2, L3 and U, V, W. 3. Check if the cable is shielded.	
Damaged encoder	Check the encoder	Change the encoder

Motor overload		
Cause	**Checking method**	**Corrective actions**
Continuous motor operation with current above nominal	1. Check if the motor power is enough to drive the inertia mass. 2. Check if the motor corresponds by power to the servo drive. 3. Check about mechanical problems with the movement.	1.Decrease the load if possible. 2.Increase the loading possibility of the motor with a gear. 3.Change the motor with bigger power if servo drive allows.
Incorrect entered parameters	1. Check parameters overload - **P3-03, P3-04, P3-05** 2. Check the time constant for acceleration and deceleration **P1-06 (ADT).**	1. Adjust parameters exactly. 2. Increase the time for acceleration / deceleration.
Incorrect received absolute rotor position	Check about normal operation of the servo drive without load.	Start again the procedure for absolute rotor position finding.
Damages in cable wiring	Check wiring on U, V, W and encoder.	Check if all wiring is correct.
Damage or incorrect control of electrical break.	1.Check the break for damage. 2.Check polarity on multifunctional output BRKD. 3.Check wiring.	Check adjustments of input functions and wiring.

Servo drive overheating		
Cause	**Checking method**	**Corrective actions**
Not enough ventilating around heat sink.	1. Check the space around the heat sink in the servo drive. 2. Check the fans	Ensure enough space according to the requirements.
Continuous operation of the motor with current higher than nominal.	1. Check if motor power is enough to control the inertia mass. 2. Check if the motor corresponds by power to the servo drive. 3. Check about mechanical problems.	1.Decrease the load if possible. 2.Increase load possibilities of the motor with gear.
Incorrect entered parameters	Check temperature threshold of this protection – parameter **P3-10 (THL)**	Adjust the parameter exactly.

Overvoltage in DC part		
Cause	**Checking method**	**Corrective actions**
Mains voltage exceeds maximum allowed value	Check with voltmeter if the input voltage gets into the range of nominal supply input voltage.	Use correct mains supply, stabilized voltage or auto-transformer.

DC voltage of capacitor battery exceeds maximum allowed value by stopping or reverse.	Check availability of internal breaking resistor between terminals **P, B.** Attention: Checking is done by switched-off apparatus from the mains supply and after 5 minutes from the switch-off moment.	Mount additional break resistor between terminals **P, B** if this is possible. Decrease the maximal speed of the motor if possible. Decrease the additional inertia torque of the machine, adjusted to the motor shaft, if this is possible.
There is damaged component in the servo drive	With voltmeter check if the input voltage gets into the defined limits.	If after checking the alarm is not cleared, please, consult with your supplier or with "Electroinvent" Ltd.
Incorrect entered parameters	Check voltage threshold for breaking resistor turn-on **P3-09 (BRL)** and over-voltage protection threshold **P3-07(VHL)**	Adjust the parameter exactly.

Undervoltage in DC part		
Cause	**Checking method**	**Corrective actions**
Mains voltage is below minimal allowed value	Check with voltmeter if the input mains voltage gets into the range of nominal supply input voltage. Check the input automate.	Use correct mains supply, stabilized voltage or auto-transformer.
Incorrect entered parameters	Check protection threshold for low voltage **P3-08(VLL)**	Adjust parameters exactly.
There is damaged component in the servo drive	With voltmeter check if the input voltage gets into the defined limits.	If after checking the alarm is not cleared, please, consult with your supplier or with "Electroinvent" Ltd.

Overcurrent – current overload		
Cause	**Checking method**	**Corrective actions**
A moment current overload	1. Check if the power of the servo drive is enough to control the inertia mass. 2. Check if corresponds to motor power. 3. Check about mechanical problems in moving part.	1.Decrease the load if possible. 2.Increase load possibilities of the motor with gear.
Short circuit in wiring or in the motor	1. Check wiring connections between servo drive and motor. 2. Check motor about damage	Remove the short circuit.
Error in connections	Check if all steps in connecting the motor to servo drive are executed correctly.	Follow the steps for wiring and reconnect the cables in accordance with the manual.
Incorrect entered parameter	1. Check the current threshold **P3-01(IPM).** 2. Check time constant for acceleration and deceleration **P1-06 (ADT).**	Adjust parameters exactly. Increase the time for acceleration / deceleration.
Incorrect received absolute rotor position	Check about normal operation of the servo drive without load.	Start again the procedure for absolute rotor position finding.
Incorrect control signal	Check if the control input command is non stable (with many fluctuations)	Check if the input control frequency is stable.

IPM power module fault		
Cause	**Checking method**	**Corrective actions**
Short circuit on servo output (U, V, W) or in the motor	1. Check wiring connections between servo drive and motor. 2. Check about short circuit in wiring. 3. Check about damage in the motor or in servo drive with the help of Ohmmeter.	Remove the short circuit or defected part. If short circuits remains, please consult with your supplier or Electroinvent Ltd.
Incorrect received absolute rotor position	Check about normal operation of the servo drive without load	Start again the procedure for absolute rotor position finding.

Brake resistor overload		
Cause	**Checking method**	**Corrective actions**
Mains voltage supply exceeds max. allowed value	With voltmeter check if the input voltage gets in the range of nominal input voltage.	Use correct mains supply, stabilized voltage or auto-transformer.
The brake resistor is not connected or its value is too low.	Check wiring connections of break resistor	Reconnect break resistor or calculate its value.
Incorrect entered parameter	Check voltage threshold for switching-on of break resistor **P3-09 (BRL)**	Adjust parameters exactly.

Position reference error		
Cause	**Checking method**	**Corrective actions**
Gain value is small.	Check referenced gain value **P1-01 (KPP**).	Adjust correctly the gain value.
Torque limitation is small	Check the value of torque limitation.	Adjust correctly the value. Of torque limitation.
There is overload	Check about overload	Reduce external load and estimate motor capabilities.
Incorrect entered parameter	1. Check if parameter **P1-06 (ADT)** is adjusted to null. 2. Increase the value of **P1-07 (VCM)**	Adjust parameters exactly.

MODBUS Communication timeout		
Cause	**Checking method**	**Corrective actions**
Communication is disconnected temporarily	Check if the communication cable is disconnected (CN1,CN2).	Change the cable.

Analog to digital converter ADC error		
Cause	**Checking method**	**Corrective actions**
Conversion problem with the signals from analog inputs	Check diagnostic parameters **P0-08(ANL1) and P0-09 (ANL2)**	If after checking the alarm is not cleared, please, consult with your supplier or "Electroinvent" Ltd.

EMGS Emergency stop activated		
Cause	**Checking method**	**Corrective actions**
"Emergency stop" button activated	Check polarity of input function	Switch-off "Emergency stop" button

DSP error		
Cause	**Checking method**	**Corrective actions**
Problem with the control module of servo drive.	If with the help of **SON or ARST**(see Chapter 3, Table 3.B) the problem remains, please, consult with your supplier or "Electroinvent" Ltd.	

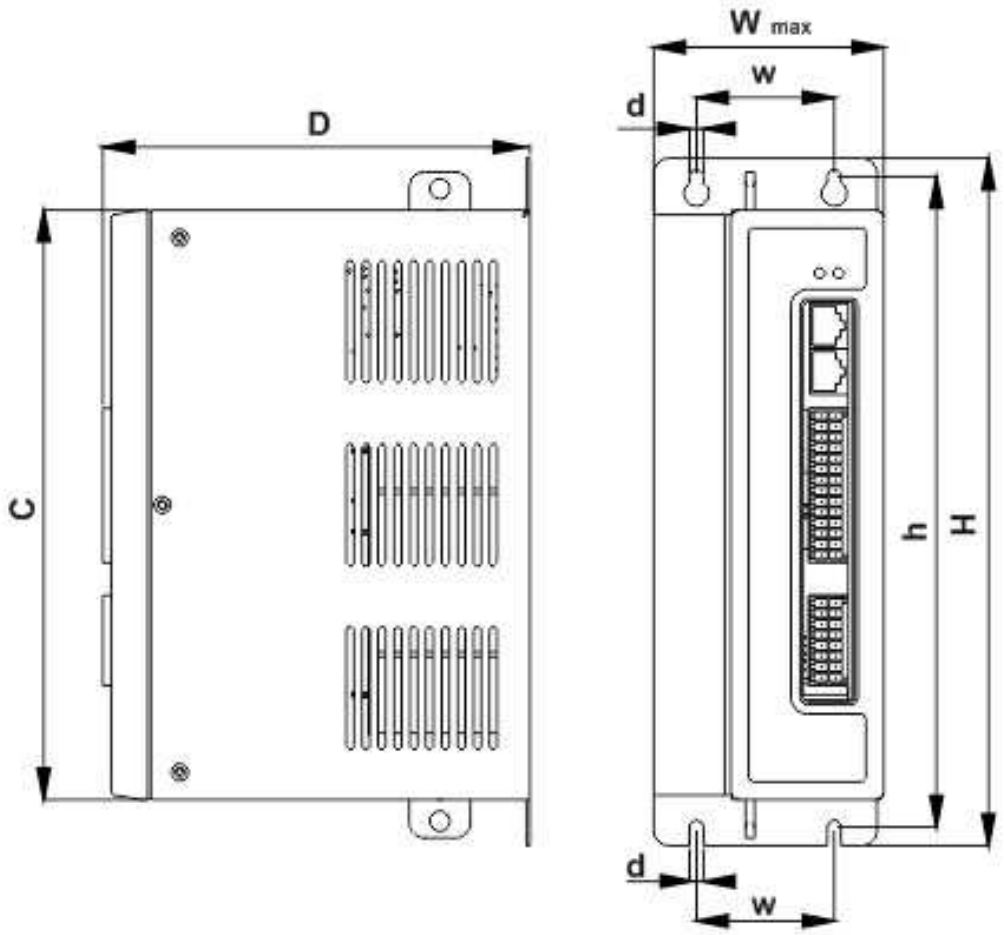
Current limit activated		
Cause	**Checking method**	**Corrective actions**
Continuous limitation of integral part of current regulator	Check if there is a big error between reference and current feedback	To be made quality adjustments of current regulator or to limit the reference at the input

Speed limit activated		
Cause	**Checking method**	**Corrective actions**
Continuous limitation of integral part of speed regulator	Check if there is a big error between reference and speed feedback	To be made quality adjustments of speed regulator or to limit the reference at the input

11. Technical specifications
11.1. Technical data

Type		ELAS	DA2			DB2		DC2			DA4				DB4		DC4		
Motor power		kW	0,55	0,75	1,1	1,5	2,2	3,0	4,0	5,5	0,75	1,1	1,5	2,2	3,0	4,0	5,5	7,5	11
Supply voltage and frequency			200÷230V3~50/60Hz			200 ÷ 230 V 3 ~ 50/60Hz					380 ÷ 400 V 3 ~ 50/60Hz								
Rated output voltage		VAC	200 ÷ 230 V 3 ~ 0 ÷ 200 Hz (corresponds to the input voltage)								380 ÷ 400 V 3 ~ 0 ÷ 200 Hz (corresponds to the input voltage)								
Nominal output current		A	3,5	5	6,5	7,5	10	15	20	25	2,5	4	5,5	7	8	10	12	20	25
Maximum output current		A	10	10	15	15	25	50	50	75	10	10	15	15	25	25	25	50	75
Motor control methods			SVPWM (SPACE VECTOR PULSE WIDTH MODULATION) CONTROL; SIN PWM																
Brake resistor			Built in (50Ω / 100W)			No					Built in (50Ω / 100W)				No				
Protective structure			IP 20																
Cooling system			No			Fan cooling					No				Fan cooling				
Speed Control Mode																			
Analog Command Input V-REF multifunctional	Voltage Range	VDC	0 ÷ +/-10VDC																
	Input Resistance	Ω	10KΩ																
Speed Control Range			1 ÷ 5000																
Torque Limit Operation			Set by parameters or via analog input																
Command Source			External analog signal / Internal parameters																
Speed Accuracy (at Rated Rotation Speed)			0.01% or less at load fluctuation 0 - 100%																
			0.01% or less at power fluctuation +/-10%																
			0.01% or less at ambient temperature fluctuation 0 - 50°C																
Position Control Mode																			
Max Input Pulse Frequency			Max 500Kpps (Line driver) / Max 200Kpps (Open collector)																
Pulse Type			Pulse + Direction; (Aphase + Bphase; CCW Pulse + CW Pulse - optional)																
Command Source			External (pulse train) / Internal (parameters)																
Electronic Gear			Electronic Gear A/B multiple (-199.00 <A/B<199.00)																
Torque Limit Operation			Set by parameters or via analog input																
Torque Control Mode																			
Analog Command Input T-REF multifunctional	Voltage Range	VDC	0 ÷ +/-10VDC																
	Input Resistance	kΩ	10kΩ																
	Time Constant	μS	2.2μS																
Speed Limit Operation			Set by parameters or via analog input																
Command Source			External (analog signal) / Internal (parameters)																
Input-output interface and protections																			
Digital Inputs			5 multifunctional programmable. Optoisolated. NPN																
Digital Outputs			3 transistor "Open collector" multifunctional programmable, 3 differential encoder signal output A/B/Z - Line Driver																
Communication Interface			RS 232 / RS 485																
Protections			Overcurrent, Overvoltage, Undervoltage, Servo Overheat, Regeneration error, Overload, Encoder error, IPM fault, Communication error and other																
Working and Storage Environment																			
Operating temperature			0°C to 55°C (If Operation temperature above specified range, forced cooling will be required)																
Storage temperature			-20°C ÷ +65°C																
Humidity			80% at 30°C (non-condensing)																

11.2. Overall dimensions



Type / kW	H, mm	Wmax, mm	D, mm	C, mm	h, mm	w, mm	d, mm
ELAS-DA2-005	225	75	150	193	215	45	4,5
ELAS-DA2-007	225	75	150	193	215	45	4,5
ELAS-DA2-011	225	75	150	193	215	45	4,5
ELAS-DB2-015	260	93	210	220	248	70	6
ELAS-DB2-022	260	93	210	220	248	70	6
ELAS-DC2-030	328	116	245	278	310	80	6,5
ELAS-DC2-040	328	116	245	278	310	80	6,5
ELAS-DC2-055	328	116	245	278	310	80	6,5
ELAS-DA4-007	225	75	150	193	215	45	4,5
ELAS-DA4-011	225	75	150	193	215	45	4,5
ELAS-DA4-015	225	75	150	193	215	45	4,5
ELAS-DA4-022	225	75	150	193	215	45	4,5
ELAS-DB4-030	260	93	210	220	248	70	6
ELAS-DB4-040	260	93	210	220	248	70	6
ELAS-DC4-055	328	116	245	278	310	80	6,5
ELAS-DC4-075	328	116	245	278	310	80	6,5
ELAS-DC4-110	328	116	245	278	310	80	6,5

11.3. Overload characteristics

To prevent the motor from overheating and damages, it is used a built-in electronic protection for the servo drive “Motor overload”.
The possible reasons for motor overloading:

- Continuous operation of the motor with current above nominal.
- Operation with big inertia mass and reference for control with high accelerations.
- Damages in wiring
- Damage in electrical brake

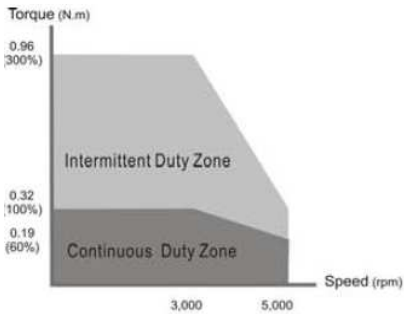
Parameters connected with these protections are:

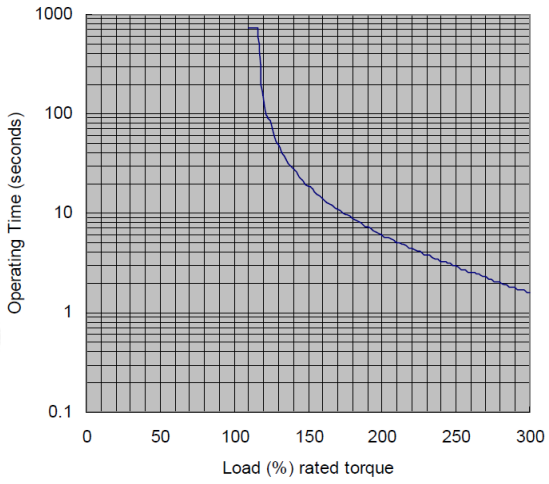
Parameters Limitations						
Parameter	**MODBUS address**	**Name**	**Function**	**Default**	**Dimension**	**Control mode**
P3-03	0318H	CL2	300% x Nominal motor current for alarm “Motor overload”	2.700	A	Pt,Pr,S,T
P3-04	030FH	CL1	120% x Nominal motor current for alarm “Motor overload”	1.000	A	Pt,Pr,S,T
P3-05	0310H	OVL	Type overload characteristics depending on the motor	0	-	Pt,Pr,S,T

For correct adjustment of the servo drive, the user is obliged to choose:

- Suitable overload characteristic of the controlled motor in **P3-05**
- To adjust the parameters connected with nominal current **P3-04 (120%In) and P3-03 (300%In)**

Overload characteristic - 0 (ACM30401)
P3-05 = 0 (OVL)

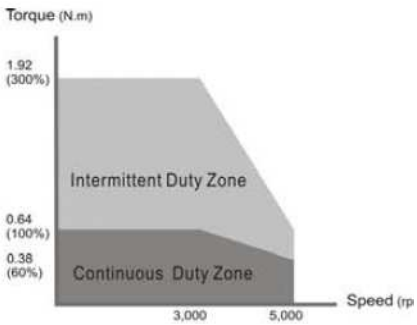


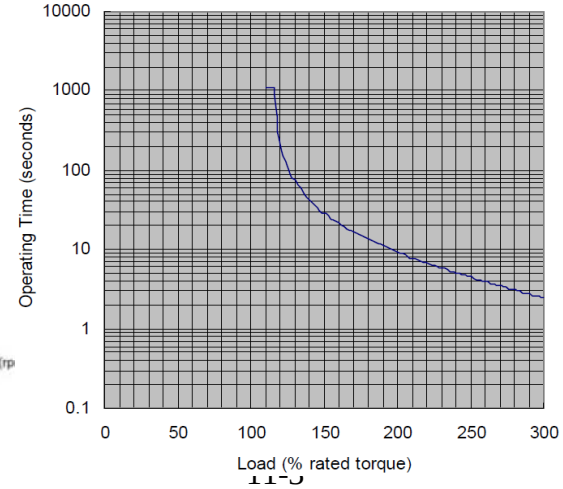


P3-05 = 0

Load	Operating Time
120%	139.335s
140%	27.585s
160%	14.235s
180%	8.9625s
200%	6s
220%	4.4925s
240%	3.2925s
260%	2.58s
280%	2.07s
300%	1.6125s

Overload characteristic - 1 (ACM30602)
P3-05 = 1 (OVL)

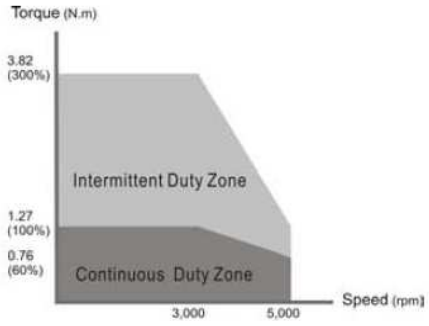


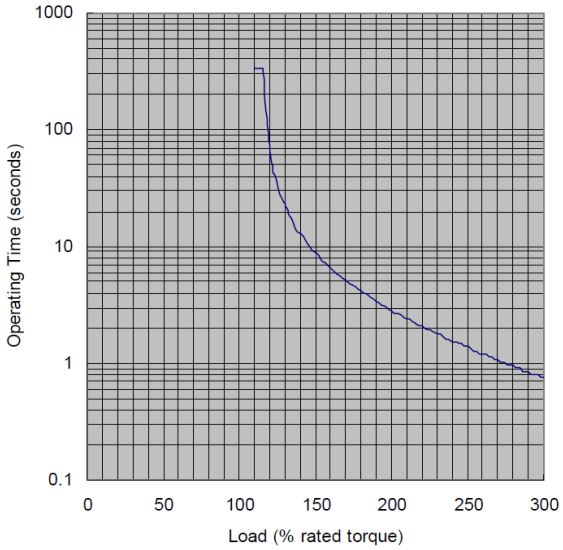


P3-05 = 1

Load	Operating Time
120%	213.6s
140%	42.3s
160%	21.8s
180%	13.7s
200%	9.2s
220%	6.9s
240%	5.0s
260%	3.9s
280%	3.2s
300%	2.5s

Overload characteristic- 2 (ACM30604)
P3-05 = 2 (OVL)

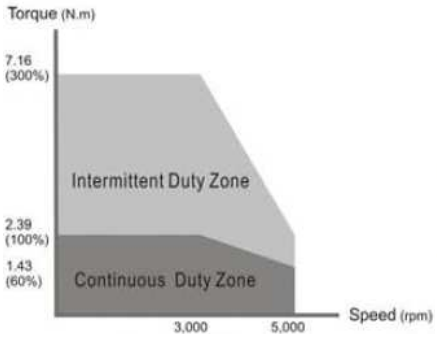


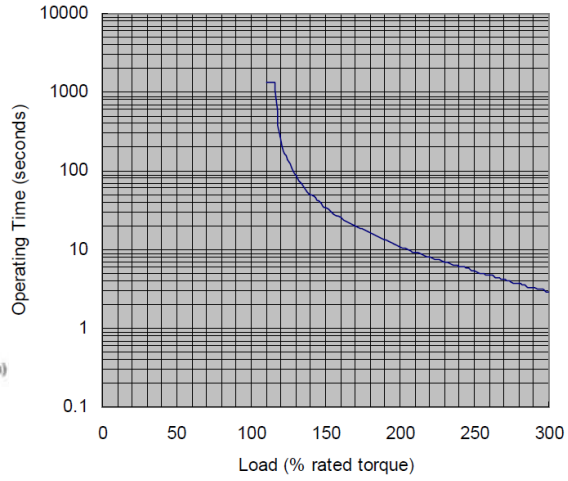


P3-05=2

Load	Operating Time
120%	65.0s
140%	12.9s
160%	6.6s
180%	4.2s
200%	2.8s
220%	2.1s
240%	1.5s
260%	1.2s
280%	1.0s
300%	0.8s

Overload characteristic - 3 (ACM30804)
P3-05 = 3 (OVL)

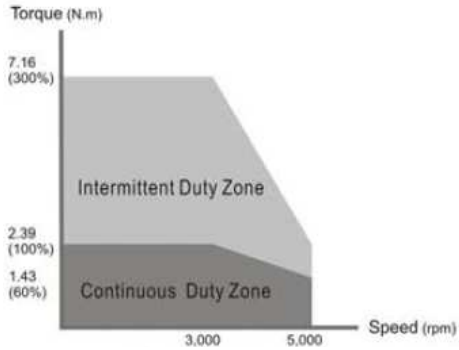


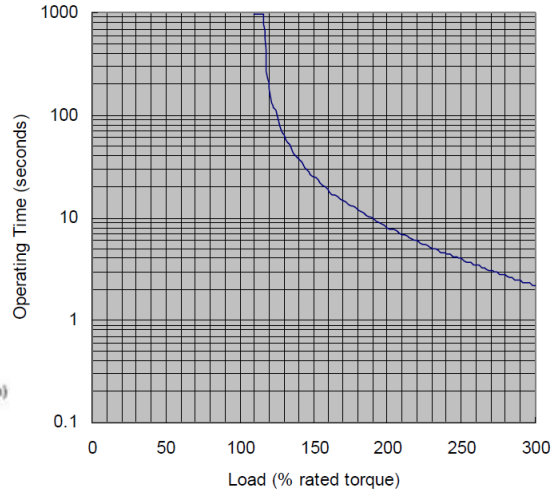


P3-05=3

Load	Operating Time
120%	254.5s
140%	50.4s
160%	26.0s
180%	16.4s
200%	11.0s
220%	8.2s
240%	6.0s
260%	4.7s
280%	3.8s
300%	2.9s

Overload characteristic - 4 (ACM30807)
P3-05 = 4 (OVL)

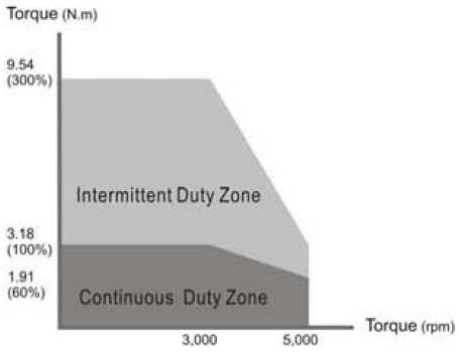


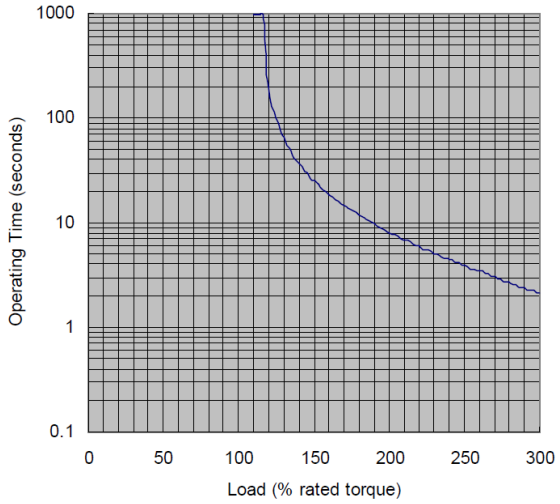


P3-05=4

Load	Operating Time
120%	185.8s
140%	36.8s
160%	19.0s
180%	12.0s
200%	8.0s
220%	6.0s
240%	4.4s
260%	3.4s
280%	2.8s
300%	2.2s

Overload characteristic - 5 (ACM31010)
P3-05 = 5 (OVL)

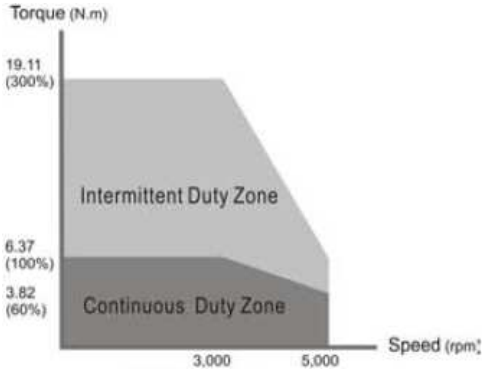


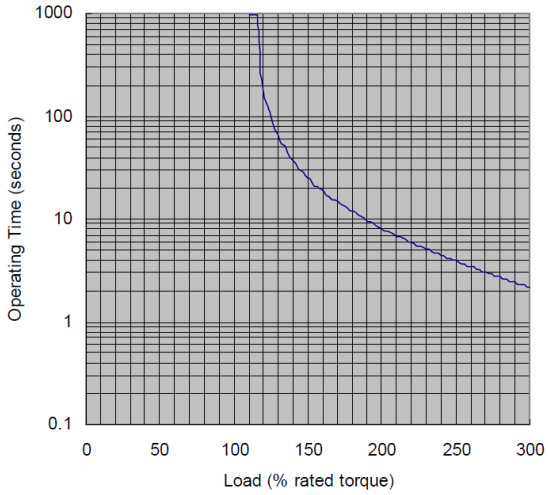


P3-05=5

Load	Operating Time
120%	185.8s
140%	36.8s
160%	19.0s
180%	12.0s
200%	8.0s
220%	6.0s
240%	4.4s
260%	3.4s
280%	2.8s
300%	2.2s

Overload characteristic - 6 (ACM31020)
P3-05 = 6 (OVL)

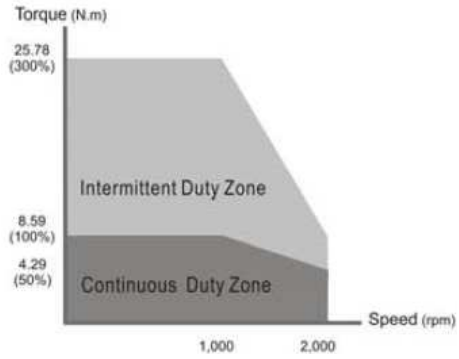


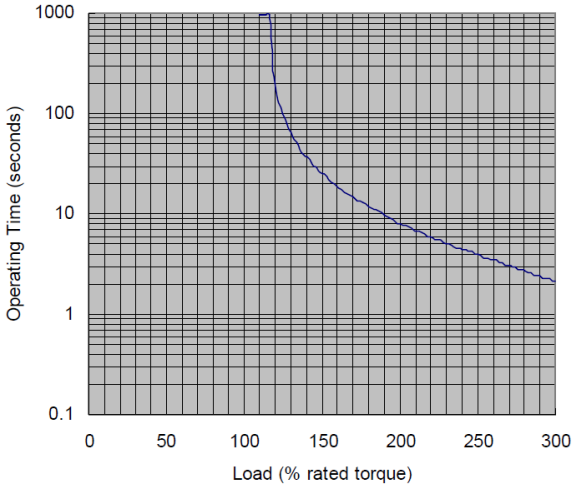


P3-05=6

Load	Operating Time
120%	185.8s
140%	36.8s
160%	19.0s
180%	12.0s
200%	8.0s
220%	6.0s
240%	4.4s
260%	3.4s
280%	2.8s
300%	2.2s

Overload characteristic - 7 (ACM31303)
P3-05 = 7 (OVL)

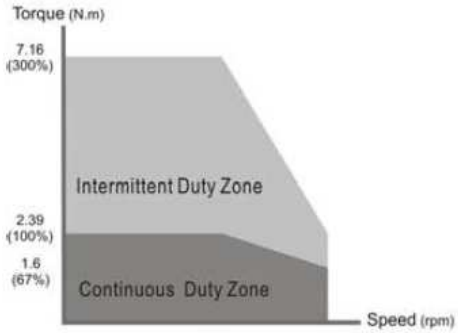


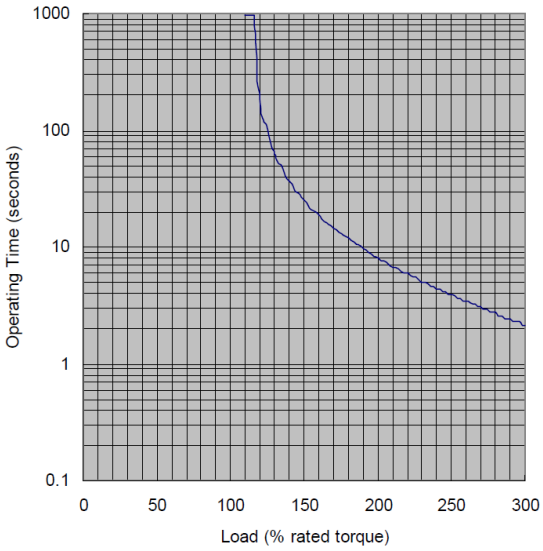


P3-05=7

Load	Operating Time
120%	185.8s
140%	36.8s
160%	19.0s
180%	12.0s
200%	8.0s
220%	6.0s
240%	4.4s
260%	3.4s
280%	2.8s
300%	2.2s

Overload characteristic - 8 (ACM31305)
P3-05 = 8 (OVL)

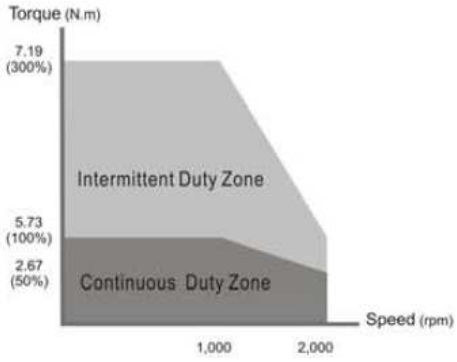


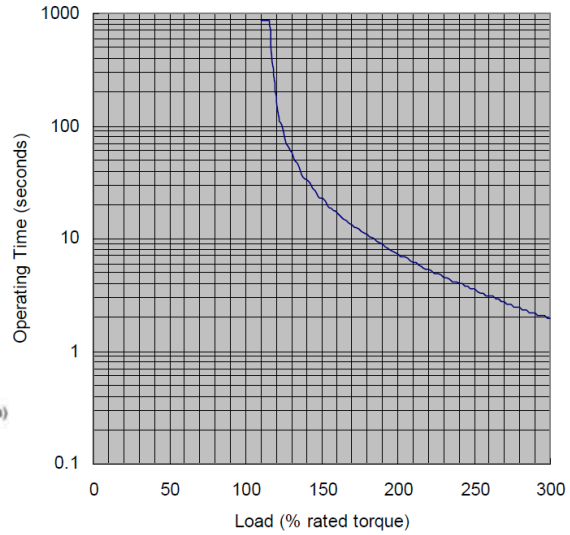


P3-05=8

Load	Operating Time
120%	185.8s
140%	36.8s
160%	19.0s
180%	12.0s
200%	8.0s
220%	6.0s
240%	4.4s
260%	3.4s
280%	2.8s
300%	2.2s

Overload characteristic - 9 (ACM31306)
P3-05 = 9 (OVL)

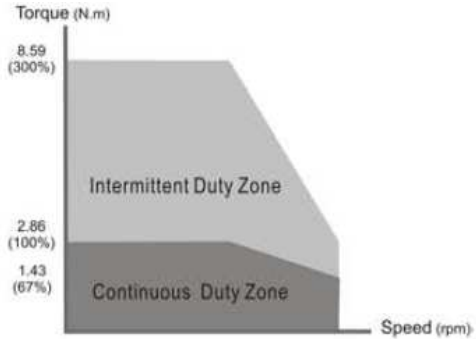


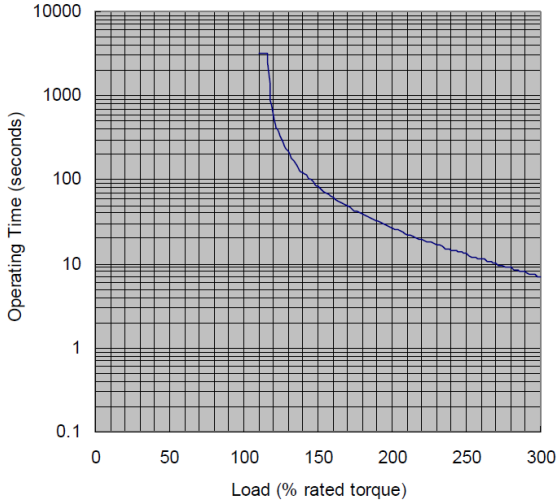


P3-05=9

Load	Operating Time
120%	167.2s
140%	33.1s
160%	17.1s
180%	10.8s
200%	7.2s
220%	5.4s
240%	4.0s
260%	3.1s
280%	2.5s
300%	1.9s

Overload characteristic - 10 (ACM31309)
P3-05 = 10 (OVL)

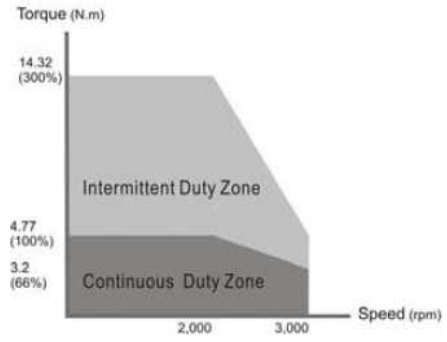


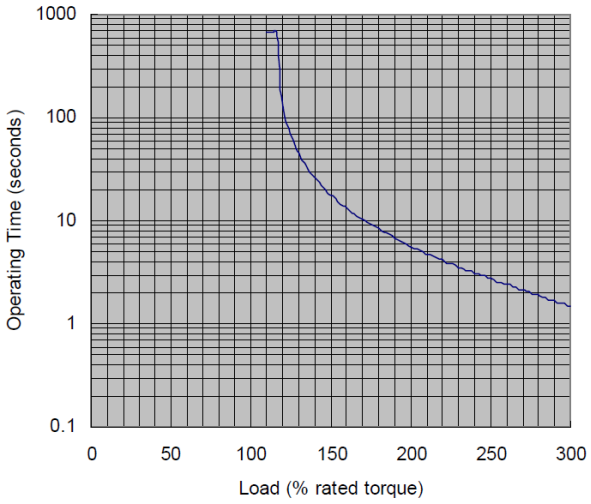


P3-05=10

Load	Operating Time
120%	613.1s
140%	121.4s
160%	62.6s
180%	39.4s
200%	26.4s
220%	19.8s
240%	14.5s
260%	11.4s
280%	9.1s
300%	7.1s

Overload characteristic - 11 (ACM31310)
P3-05 = 11 (OVL)

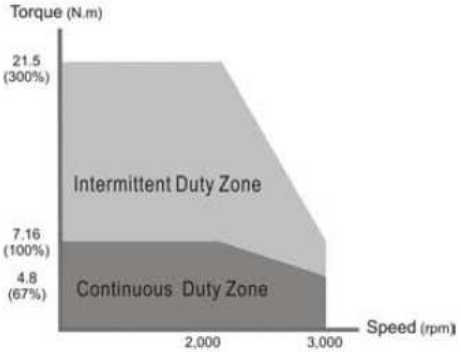


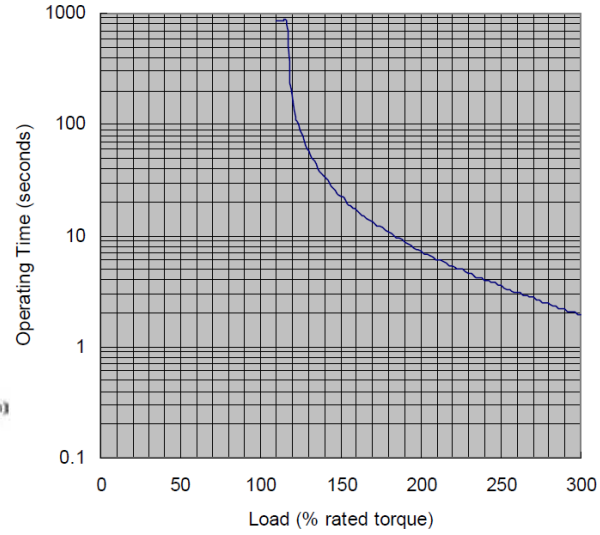


P3-05=11

Load	Operating Time
120%	130.0s
140%	25.7s
160%	13.3s
180%	8.4s
200%	5.6s
220%	4.2s
240%	3.1s
260%	2.4s
280%	1.9s
300%	1.5s

Overload characteristic - 12 (ACM31315)
P3-05 = 12 (OVL)

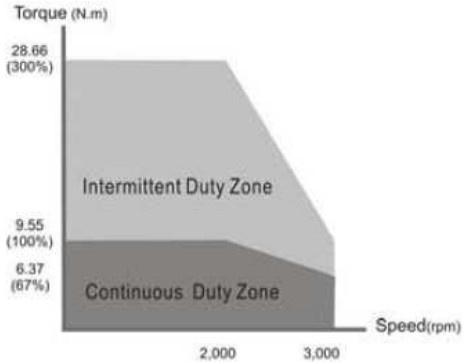


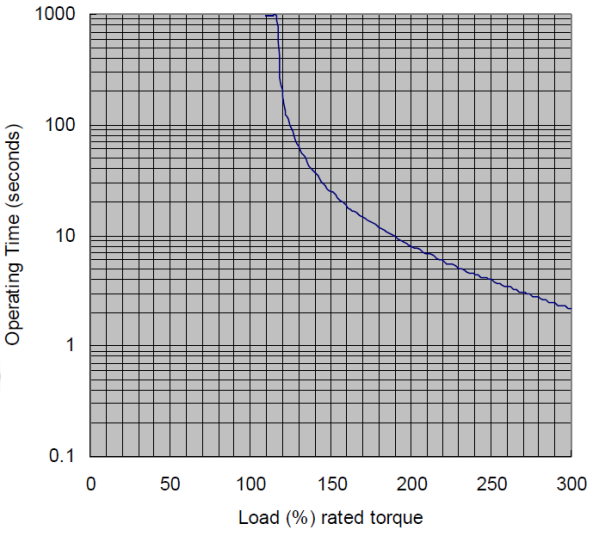


P3-05=12

Load	Operating Time
120%	167.2s
140%	33.1s
160%	17.1s
180%	10.8s
200%	7.2s
220%	5.4s
240%	4.0s
260%	3.1s
280%	2.5s
300%	1.9s

Overload characteristic - 13 (ACM31320)
P3-05 = 13 (OVL)

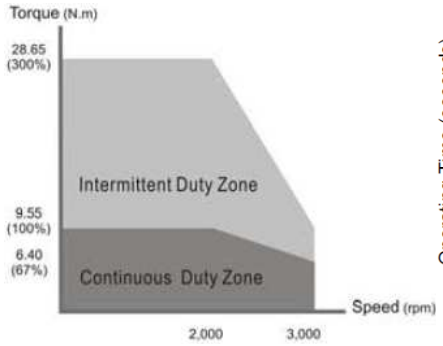


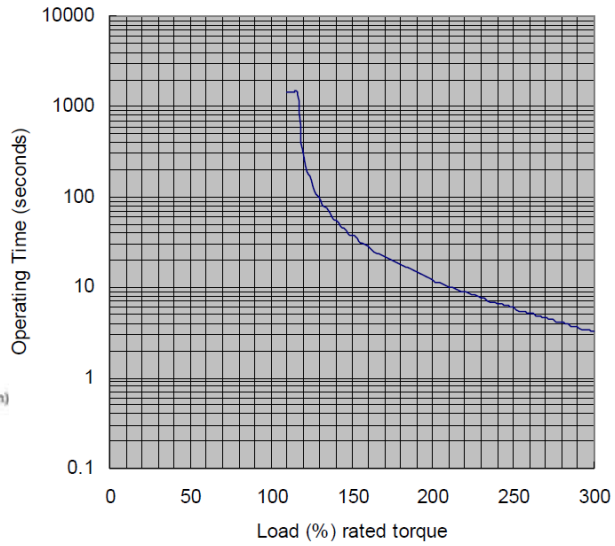


P3-05=13

Load	Operating Time
120%	185.78s
140%	36.78s
160%	18.98s
180%	11.95s
200%	8s
220%	5.99s
240%	4.39s
260%	3.44s
280%	2.76s
300%	2.15s

Overload characteristic - 14 (ACM31820)
P3-05 = 14 (OVL)





P3-05=14

Load	Operating Time
120%	278.67s
140%	55.17s
160%	28.47s
180%	17.925s
200%	12s
220%	8.985s
240%	6.585s
260%	5.16s
280%	4.14s
300%	3.225s