

FAGOR AUTOMATION S.COOP.

Brushless AC
servo drives
~ **MCP Series** ~

Ref.1104



FAGOR 



14460064

Title	Brushless AC Servo Drives. MCP series
Type of documentation	Description, installation and startup of motors and digital drives.
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34-943-719200



34-943-771118 (Technical Service Depart.)

The information described in this manual may be subject to changes due to technical modifications. FAGOR AUTOMATION, S. Coop. reserves the right to change the contents of this manual without prior notice.

The contents of this manual have been verified and matched with the product described here. Even so, it may contain involuntary errors that make it impossible to ensure an absolute match. However, the contents of this document are regularly checked and updated implementing the pertinent corrections in a later edition.

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WARRANTY

INITIAL WARRANTY

All products manufactured or marketed by FAGOR carry a 12-month warranty for the end user.

In order to prevent the possibility of having the time period from the time a product leaves our warehouse until the end user actually receives it run against this 12-month warranty, the OEM or distributor must communicate to FAGOR the destination, identification and installation date of the machine by filling out the Warranty Form that comes with each product.

The starting date of the warranty for the user will be the one appearing as the installation date of the machine on the warranty form.

This system ensures the 12-month warranty period for the user.

FAGOR offers a 12-month period for the OEM or distributor for selling and installing the product. This means that the warranty starting date may be up to one year after the product has left our warehouse so long as the warranty control sheet has been sent back to us. This translates into the extension of warranty period to two years since the product left our warehouse. If this sheet has not been sent to us, the warranty period ends 15 months from when the product left our warehouse.

FAGOR is committed to repairing or replacing its products from the time when the first such product was launched up to 8 years after such product has disappeared from the product catalog.

It is entirely up to FAGOR to determine whether a repair is to be considered under warranty.

EXCLUDING CLAUSES

The repair will take place at our facilities. Therefore, all shipping expenses as well as travelling expenses incurred by technical personnel are NOT under warranty even when the unit is under warranty.

The warranty will be applied so long as the equipment has been installed according to the instructions, it has not been mistreated or damaged by accident or negligence and has been handled by personnel authorized by FAGOR.

If once the service call or repair has been completed, the cause of the failure is not to be blamed on the FAGOR product, the customer must cover all generated expenses according to current fees.

No other implicit or explicit warranty is covered and FAGOR AUTOMATION shall not be held responsible, under any circumstances, of the damage which could be originated.

SERVICE CONTRACTS

Service and Maintenance Contracts are available for the customer within the warranty period as well as outside of it.

DECLARATION OF CONFORMITY

Manufacturer: Fagor Automation, S. Coop.

Bº San Andrés 19, C.P. 20500, Mondragón - Guipúzcoa - (SPAIN)

We hereby declare, under our responsibility that the product:

Fagor AC Brushless Servo Drive System

consisting of the following drives modules:

MCP- 05L, MCP-10L, MCP-20L, MCP- 30L, MCP- 04H, MCP- 08H, MCP-16H

and axis feed servo motors:

FXM1, FXM3, FXM5, FXM7, FKM2, FKM4, FKM6

Note. Some additional characters may follow the model references indicated above. They all comply with the directives listed here. However, compliance may be verified on the label of the unit itself.

mentioned on this declaration, meet the requirements on:

Safety

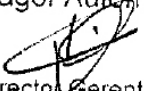
EN 60204 -1: Machinery safety. Electrical equipment of the machines.
2006 Part 1: General requirements.

Electromagnetic Compatibility

EN 61800-3: EMC directive on servo drive systems.
2004

In compliance with EC Directives 2006/95/EC on Low Voltage and 2004/108/CE on Electrical Compatibility.

Fagor Automation, S. Coop.


Director Gerente
Pedro Ruiz de Aguirre

In Mondragón July 1st, 2009.

INTRODUCTION

Fagor offers you a wide range of servo drive systems (AC Brushless motor and Digital Drive) for applications requiring between 1.2 and 33.6 Nm at speeds between 1200 rev/min and 4000 rev/min for FXM motors and between 1.7 and 23.5 Nm at speeds between 2000 rev/min and 6000 rev/min for FKM motors.

This manual describes the elements in detail and guides step by step through the installation and setup of the drive system.

When installed for the first time, it is a good idea to read the whole document.

Should you have any doubts or questions, please do not hesitate to contact our technicians at any of our subsidiaries worldwide.

Thank you for choosing Fagor.

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BRUSHLESS AC MOTORS, FXM

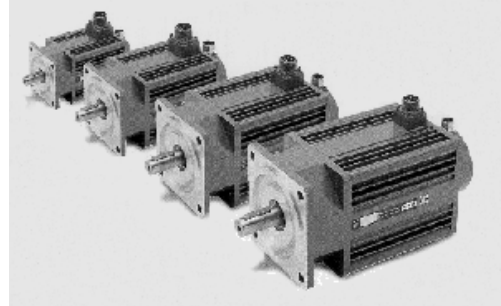
Introduction

FXM series synchronous servo motors are AC Brushless, with permanent magnets.

They are ideal for any application requiring great positioning accuracy.

They have a uniform output torque, high reliability and low maintenance.

FXM1 FXM3 FXM5 FXM7

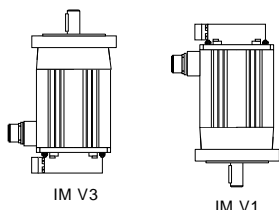


They are designed to meet the IP 64 protection standard and, therefore, they are immune to liquid and dirt.

They incorporate a temperature sensor for monitoring the internal temperature.

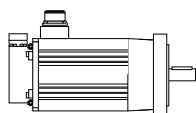
They also carry an optional electromechanical brake.

Meaning of the codes for the mounting method:



IM V3

IM V1



IM B5

Excitation	Permanent rare earth magnets (SmCo)
Temperature sensor	Thermistor
Shaft end	Cylindrical with keyway (optional: without keyway)
Mounting	Face flange
Mounting method	IM B5, IM V1, IM V3 (as per IEC-34-3-72)
Mechanical tolerances	Normal class (meets IEC-72/1971)
Balancing	Class N (Class R optional) meets DIN 45665 Balanced with the whole key
Roller bearings' life	20000 hours
Noise	DIN 45635
Vibration resistance	Withstands 1g along the shaft and 3g sideways. Take $g=10 \text{ m/s}^2$.
Electrical insulation	Class F (150°C ~ 302°F)
Insulation resistance	500 V DC, 10 MΩ or greater
Dielectric rigidity	1500 V AC, 1 minute
Protection degree	IP 64 standard configuration; IP 65 with oil seal
Storage temperature	From - 20°C to + 80°C (- 4°F to 176°F)
Ambient temperature	From 0°C to + 40°C (32°F to 104°F)
Ambient humidity	From 20% to 80% (non condensing)
Brake	Optional in all models. See section: "brake characteristics"
Feedback	Incremental TTL encoder (FXM with F winding) SinCos™ or SinCoder™ encoder (FXM with A winding)

IP 64 means that it is protected against dust and against water jets. The F class isolation on the motor maintains the dielectric properties as long as the work temperature stays below 150°C (302°F).

Non-ventilated motors	Stall torque		Stall peak torque	Rated speed	Stall current	Peak current	Power	Torque constant	Acceleration time	Inductance per phase	Resistance per phase	Inertia I_L	Mass M	Peak torque			
	Mo Nm	Mp Nm												MCP-05L Nm	MCP-10L Nm	MCP-20L Nm	MCP-30L Nm
FXM11.40F.□□□□	1.2	6	6	4000	2.0	10.1	0.5	0.6	8.4	12.0	4.60	1.2	3.3	3.0	6.0		
FXM12.40F.□□□□	2.3	11	11	4000	3.9	19.3	1.0	0.6	7.2	5.5	1.45	1.9	4.3		6.0	11.0	
FXM13.40F.□□□□	3.3	16	16	4.000	5.6	28.0	1.4	0.6	6.8	3.5	0.80	2.6	6.4			12.0	16.0
FXM14.20F.□□□□	4.1	20	20	2000	3.5	17.2	0.9	1.2	3.5	10.0	2.30	3.3	7.6		12.0	20.0	
FXM14.40F.□□□□	4.1	20	20	4000	6.9	34.0	1.7	0.6	6.9	2.6	0.55	3.3	7.6			12.0	18.0
FXM31.20F.□□□□	2.6	13	13	2000	2.2	11.0	0.5	1.2	5.6	24.0	5.05	3.5	5.5	6.0		12.0	
FXM31.40F.□□□□	2.6	13	13	4000	4.4	22.0	1.1	0.6	11.3	6.1	1.25	3.5	5.5		6.0	12.0	13.0
FXM32.20F.□□□□	5.1	25	25	2000	4.3	22.0	1.1	1.2	5.0	11.0	1.65	6.0	7.5		12.0	24.0	25.0
FXM32.40F.□□□□	5.1	25	25	4000	8.4	42.0	2.1	0.6	10.1	2.9	0.44	6.0	7.5			12.0	18.0
FXM33.20F.□□□□	7.3	36	36	2000	6.3	31.0	1.5	1.2	4.9	6.7	0.90	8.5	9.6			24.0	36.0
FXM33.40F.□□□□	7.3	36	36	4000	12.0	60.0	3.1	0.6	9.9	1.8	0.25	8.5	9.6				18.0
FXM34.20F.□□□□	9.3	46	46	2000	7.6	38.0	1.9	1.2	5.0	5.3	0.65	11.0	11.5			24.0	36.0
FXM34.40F.□□□□	9.3	46	46	4000	15.0	76.0	3.9	0.6	10.0	1.3	0.17	11.0	11.5				18.0
FXM53.20F.□□□□	11.9	59	59	2000	9.9	49.0	2.5	1.2	7.8	5.0	0.45	22.0	15.8			24.0	36.0
FXM53.30F.□□□□	11.9	59	59	3000	14.8	73.0	3.7	0.8	11.7	2.2	0.20	22.0	15.8				36.0
FXM54.20F.□□□□	14.8	74	74	2000	12.7	64.0	3.1	1.2	8.2	3.4	0.27	29.0	17.8				36.0
FXM55.12F.□□□□	17.3	86	86	1200	9.1	45.0	2.2	1.9	5.3	7.2	0.55	36.0	20.0			38.0	57.0
FXM55.20F.□□□□	17.3	86	86	2000	15.0	77.0	3.6	1.1	8.8	2.5	0.19	36.0	20.0				33.6
FXM73.12F.□□□□	20.8	104	104	1200	10.7	54.0	2.6	1.9	7.4	9.8	0.60	61.0	29.0				57.0
FXM74.12F.□□□□	27.3	135	135	1200	13.5	67.0	3.4	2.0	7.4	7.8	0.45	79.0	31.6				60.0
FXM75.12F.□□□□	29.5	165	165	1200	15.0	85.0	3.7	2.0	7.4	5.9	0.31	97.0	36.0				60.0

1/ When adding the mechanical brake to the motor also take into account the inertia values given in the table of section "brake characteristics".

2/ When adding the mechanical brake to the motor also take into account its mass values given in the table of section "brake characteristics".

Note: The drive recommended to govern each motor must supply the rated current needed to obtain the rated torque from the motor.

Characteristics table of non-ventilated FXM motors with "F" winding (220 V AC)

Non-ventilated motors	Stall torque Mo Nm	Stall peak torque Mp Nm	Rated speed nN rev/min	Stall current Io Arms	Peak current Imax Arms	Power Pow kW	Torque constant Kt Nm/Arms	Acceleration time tac ms	Inductance per phase L mH	Resistance per phase R Ω	Inertia J ₁ kg·cm ²	Mass M ₂ kg	Peak torque		
													MCP-04H Nm	MCP-08H Nm	MCP-16H Nm
FXM11.20A.□□.□□□□	1.2	6	2000	0.45	2.2	0.3	2.7	4.2	248	93.5	1.2	3.3	6.0		
FXM11.30A.□□.□□□□	1.2	6	3000	0.67	3.4	0.4	1.8	6.3	110	43.0	1.2	3.3	6.0		
FXM11.40A.□□.□□□□	1.2	6	4000	0.90	4.5	0.5	1.3	8.4	62	23.5	1.2	3.3	5.2	6.0	
FXM12.20A.□□.□□□□	2.3	11	2000	0.86	4.1	0.5	2.7	3.6	111	32.0	1.9	4.3	10.7	11.0	
FXM12.30A.□□.□□□□	2.3	11	3000	1.29	6.2	0.7	1.8	5.4	49	13.0	1.9	4.3	7.1	11.0	
FXM12.40A.□□.□□□□	2.3	11	4000	1.72	8.2	1.0	1.3	7.2	28	7.8	1.9	4.3	5.4	10.7	11.0
FXM13.20A.□□.□□□□	3.3	16	2000	1.23	6.0	0.7	2.7	3.4	71	16.0	2.6	6.4	10.7	16.0	
FXM13.30A.□□.□□□□	3.3	16	3000	1.85	9.0	1.0	1.8	5.1	32	7.25	2.6	6.4	7.1	14.2	16.0
FXM13.40A.□□.□□□□	3.3	16	4000	2.50	12.0	1.4	1.3	6.8	18	4.05	2.6	6.4		10.6	16.0
FXM14.20A.□□.□□□□	4.1	20	2000	1.53	7.5	0.9	2.7	3.5	52	12.0	3.3	7.6	10.7	20.0	
FXM14.30A.□□.□□□□	4.1	20	3000	2.30	11.2	1.3	1.8	5.2	23	4.85	3.3	7.6		14.2	20.0
FXM14.40A.□□.□□□□	4.1	20	4000	3.10	15.0	1.7	1.3	6.9	13	2.95	3.3	7.6		10.6	20.0
FXM31.20A.□□.□□□□	2.6	13	2000	0.97	4.8	0.5	2.7	5.6	126	29.0	3.5	5.5	10.7	13.0	
FXM31.30A.□□.□□□□	2.6	13	3000	1.45	7.3	0.8	1.8	8.5	56	12.5	3.5	5.5	7.2	13.0	
FXM31.40A.□□.□□□□	2.6	13	4000	1.92	9.6	1.1	1.4	11.3	32	7.25	3.5	5.5	5.4	10.8	13.0
FXM32.20A.□□.□□□□	5.1	25	2000	1.89	9.2	1.1	2.7	5.0	56	9.55	6.0	7.5	10.8	21.6	25.0
FXM32.30A.□□.□□□□	5.1	25	3000	2.80	14.0	1.6	1.8	7.5	25	4.05	6.0	7.5		14.6	25.0
FXM32.40A.□□.□□□□	5.1	25	4000	3.80	18.5	2.1	1.4	10.1	14	2.3	6.0	7.5		10.7	21.4

1/ When adding the mechanical brake to the motor also take into account the inertia values given in the table of section “brake characteristics”.

2/ When adding the mechanical brake to the motor also take into account its mass values given in the table of section “brake characteristics”.

Note: The drive recommended to govern each motor must supply the rated current needed to obtain the rated torque from the motor.

Characteristics table of non-ventilated FXM motors with “A” winding (400 V AC)

Non-ventilated motors	Stall torque Mo Nm	Stall peak torque Mp Nm	Rated speed nN rev/min	Stall current Io Arms	Peak current Imax Arms	Power Pow kW	Torque constant Kt Nm/Arms	Acceleration time tac ms	Inductance per phase L mH	Resistance per phase R Ω	Inertia I_1 J kg-cm ²	Mass M_2 kg	Peak torque			
													MCP-04H Nm	MCP-08H Nm	MCP-16H Nm	
FXM33.20A.□□.□□□□	7.3	36	2000	2.7	13.4	1.5	2.7	4.9	36	5.05	8.5	9.6	21.6	36.0		
FXM33.30A.□□.□□□□	7.3	36	3000	4.1	20.0	2.3	1.8	7.4	16	2.20	8.5	9.6	14.2	28.5		
FXM33.40A.□□.□□□□	7.3	36	4000	5.5	27.0	3.1	1.3	9.9	8.6	1.15	8.5	9.6		21.3		
FXM34.20A.□□.□□□□	9.3	46	2000	3.4	17.0	1.9	2.7	5.0	26	3.45	11.0	11.5	21.9	43.8		
FXM34.30A.□□.□□□□	9.3	46	3000	5.1	25.0	2.9	1.8	7.5	12	1.60	11.0	11.5		29.1		
FXM34.40A.□□.□□□□	9.3	46	4000	6.9	34.0	3.9	1.4	10.0	6.6	0.85	11.0	11.5		21.6		
FXM53.12A.□□.□□□□	11.9	59	1200	2.8	14.0	1.5	4.2	4.7	61	5.85	22.0	15.8	34.0	59.0		
FXM53.20A.□□.□□□□	11.9	59	2000	4.7	23.0	2.5	2.5	7.8	22	2.15	22.0	15.8		40.5		
FXM53.30A.□□.□□□□	11.9	59	3000	7.1	35.0	3.7	1.7	11.7	9.6	0.91	22.0	15.8		26.9		
FXM54.12A.□□.□□□□	14.8	74	1200	3.5	17.6	1.9	4.2	4.9	44	3.70	29.0	17.8	33.8	67.7		
FXM54.20A.□□.□□□□	14.8	74	2000	5.9	30.0	3.1	2.5	8.2	16	1.35	29.0	17.8		40.2		
FXM54.30A.□□.□□□□	14.8	74	3000	8.7	44.0	4.7	1.7	12.3	7.3	0.64	29.0	17.8		27.2		
FXM55.12A.□□.□□□□	17.3	86	1200	4.1	20.0	2.2	4.2	5.3	36	2.95	36.0	20.0	33.8	67.5		
FXM55.20A.□□.□□□□	17.3	86	2000	6.7	33.0	3.6	2.6	8.8	13	1.05	36.0	20.0		41.3		
FXM73.12A.□□.□□□□	20.8	104	1200	4.9	25.0	2.6	4.2	7.4	46	3.05	61.0	29.0		67.8		
FXM73.20A.□□.□□□□	20.8	104	2000	8.2	41.0	4.4	2.5	12.3	17	1.10	61.0	29.0		40.6		
FXM74.12A.□□.□□□□	27.3	135	1200	6.6	32.0	3.4	4.2	7.4	33	1.90	79.0	31.6		66.2		
FXM75.12A.□□.□□□□	33.6	165	1200	8.0	39.0	4.2	4.2	7.4	27	1.45	97.0	36.0		67.2		

1/ When adding the mechanical brake to the motor also take into account the inertia values given in the table of section "brake characteristics".

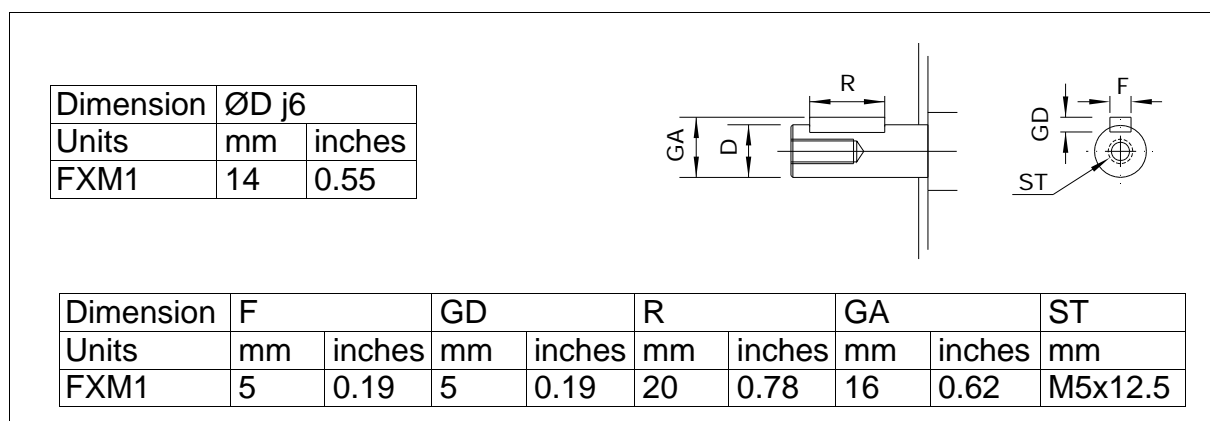
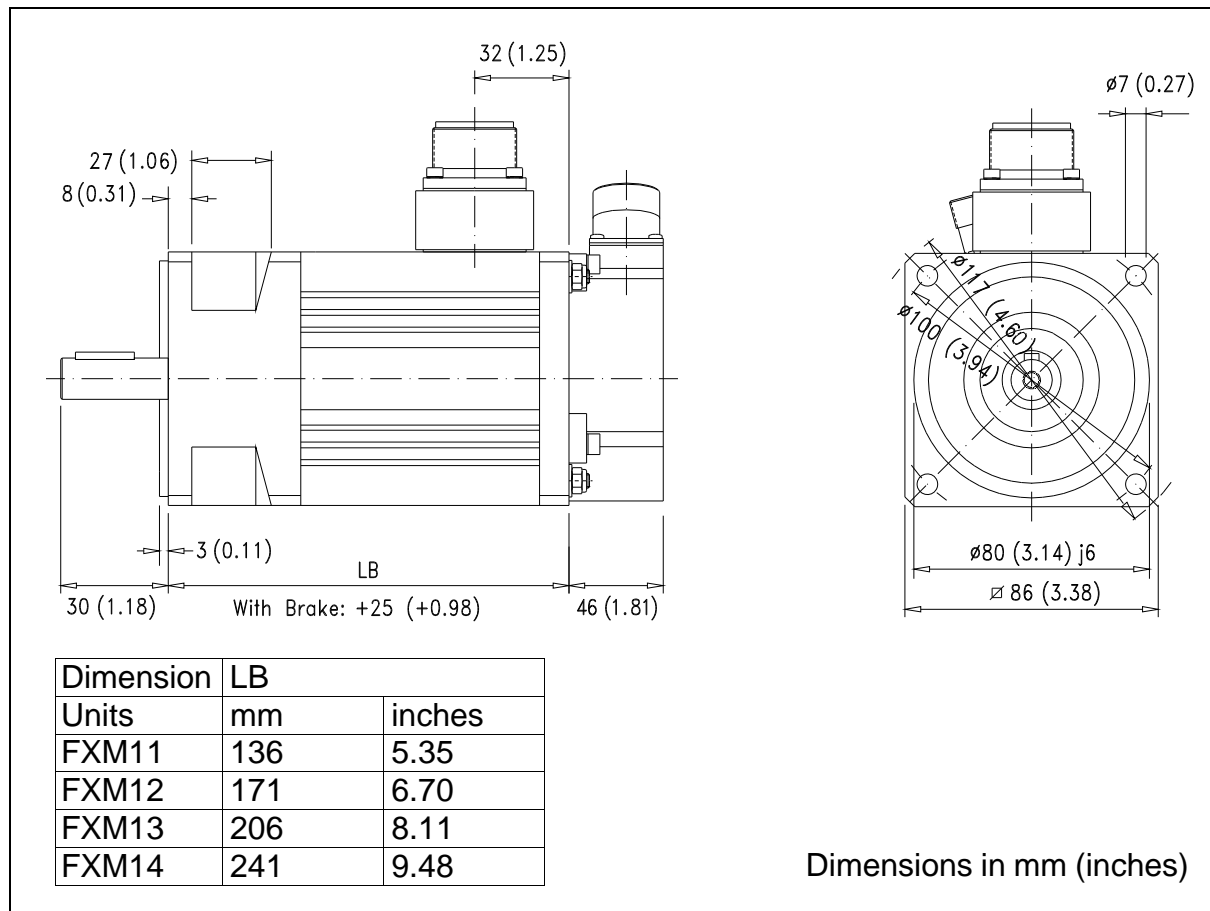
2/ When adding the mechanical brake to the motor also take into account its mass values given in the table of section "brake characteristics".

Note: The drive recommended to govern each motor must supply the rated current needed to obtain the rated torque from the motor.

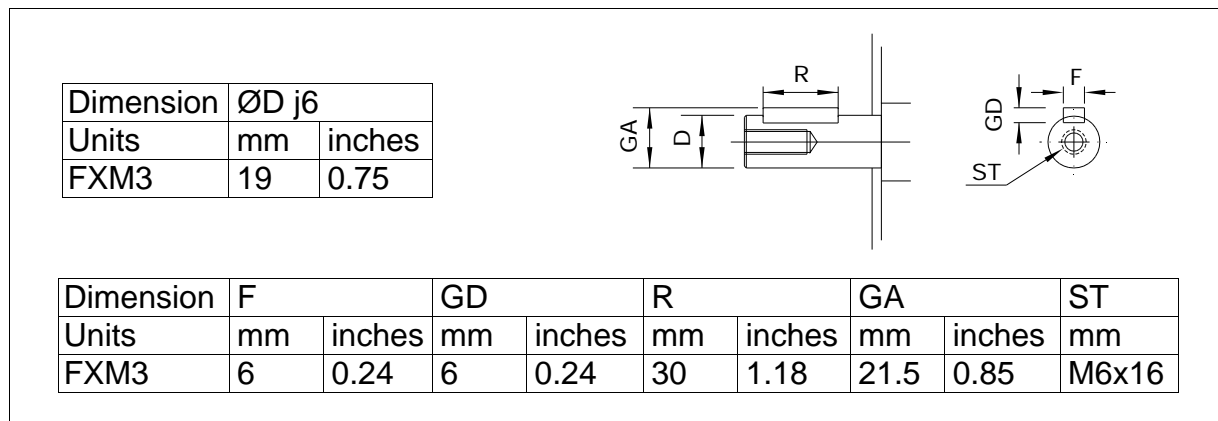
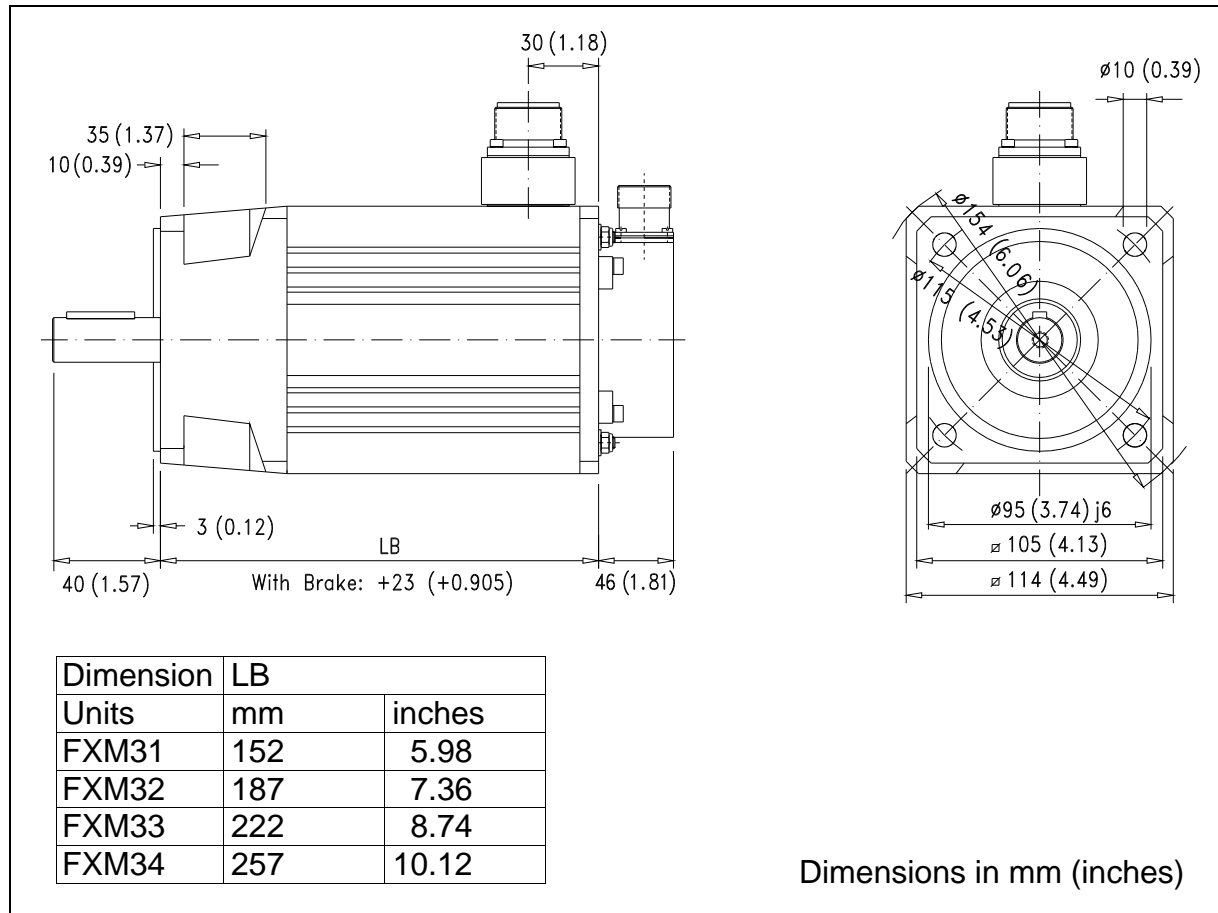
Characteristics table of non-ventilated FXM motors with "A" winding (400 V AC)

Dimensions

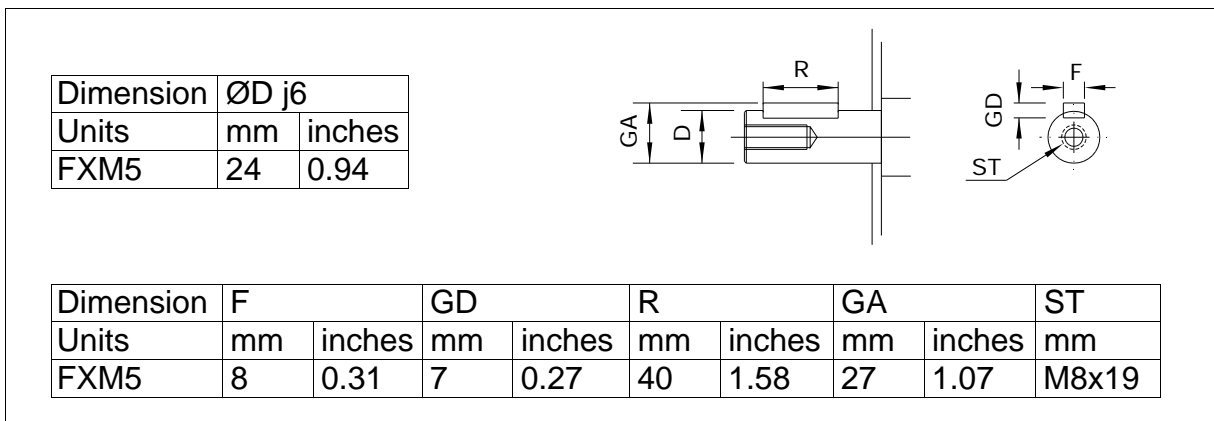
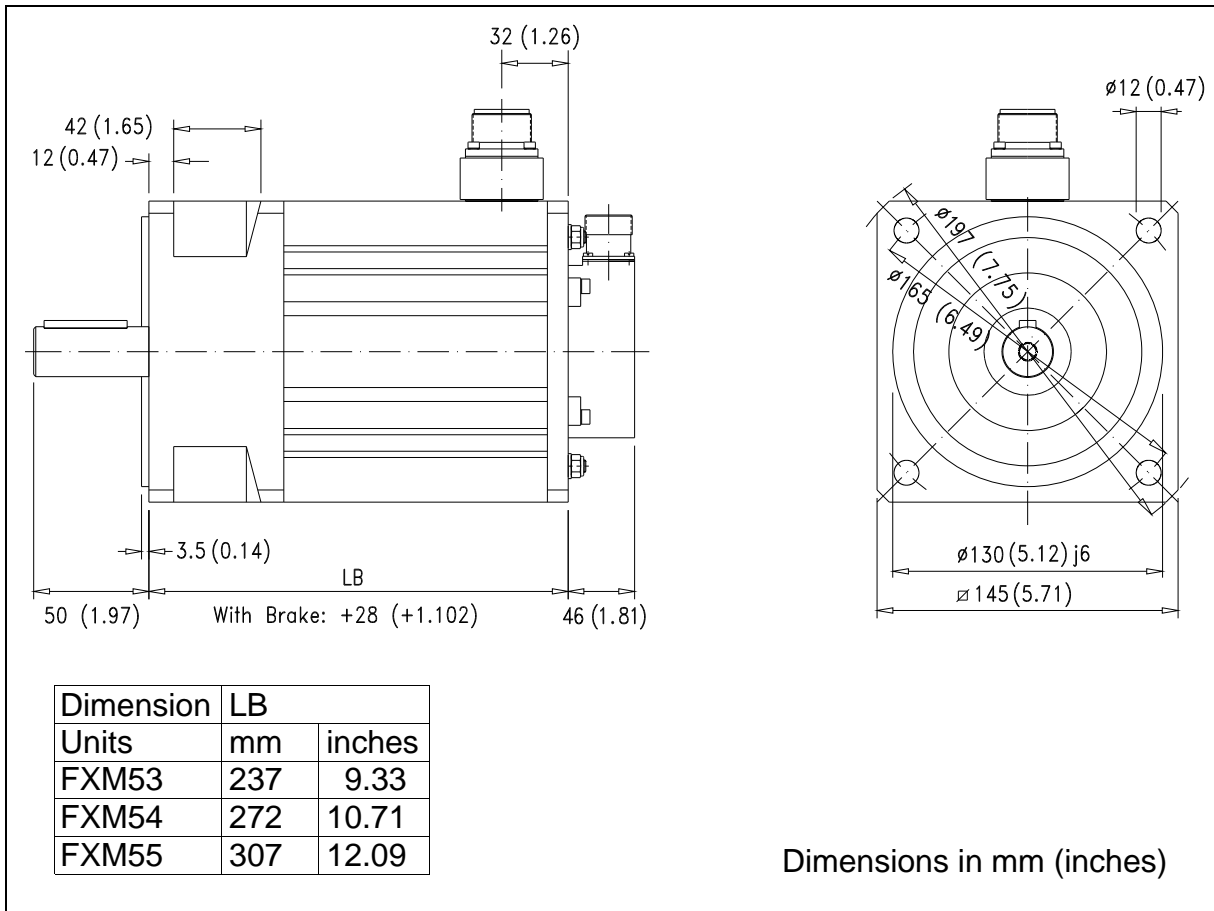
FXM1 series



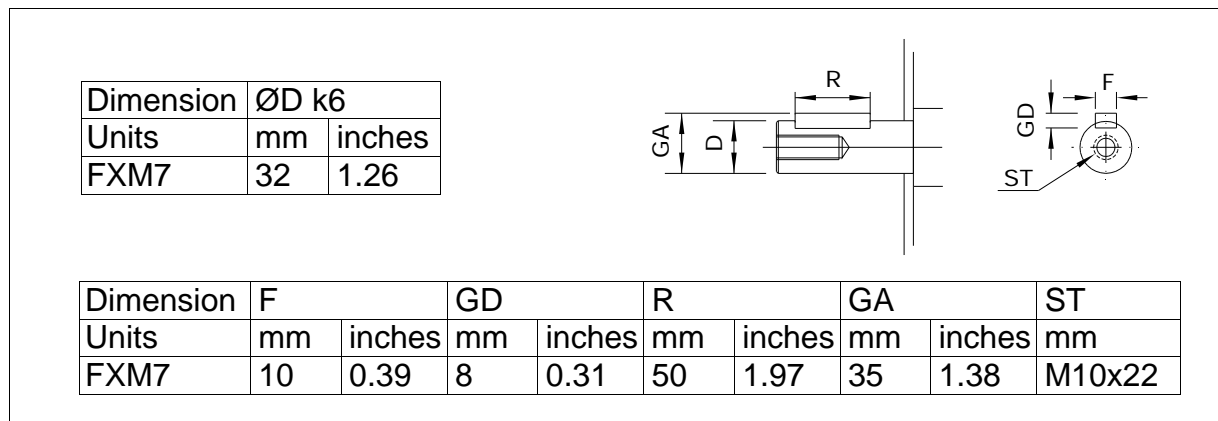
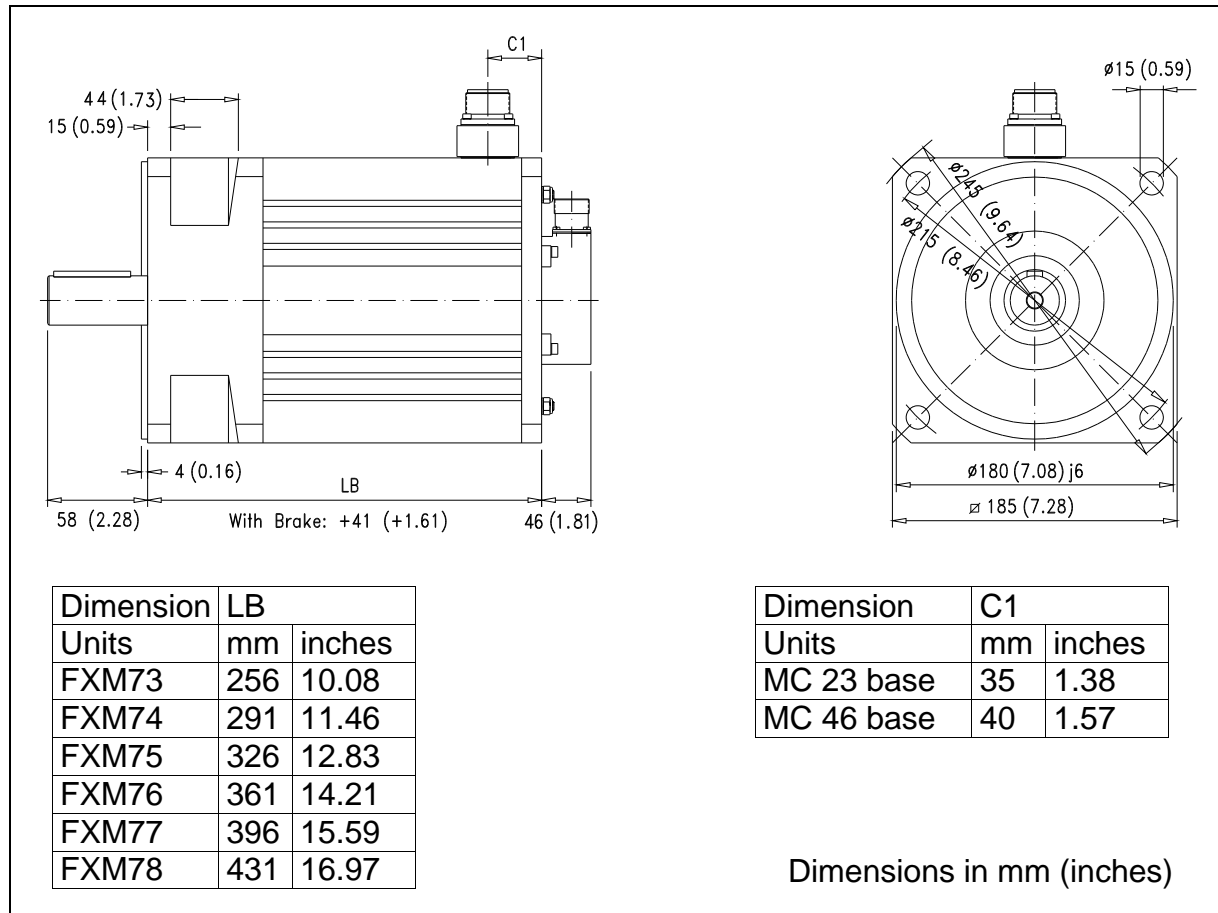
FXM3 series



FXM5 series



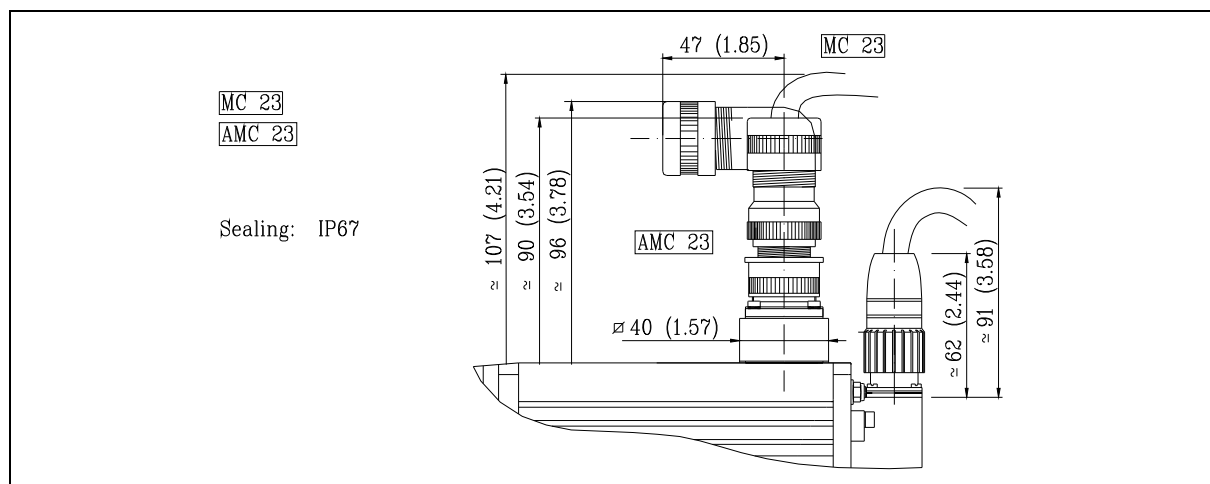
FXM7 series



Power connectors and encoder output

The power connector includes the brake terminals (E, F). A voltage between 22 and 26 V DC applied to the brake releases the shaft . When installing the motor, verify that the brake releases the shaft completely before turning it for the first time. Connecting the motor windings in the order indicated on the connector (U, V, W), the shaft will turn clockwise (CWR, clockwise rotation).

Pins I and J of the encoder connector correspond to the thermistor for monitoring motor temperature.



POWER CONNECTORS	Example:	MC - 23
MOTOR CONNECTOR	MC	Straight
	AMC	Angled
CURRENT	23	Amperes

MOTOR POWER CONNECTION BASE

MC 23 or AMC 23

PIN	SIGNAL
A	Phase U
B	Phase V
C	Phase W
D	Ground
E	Brake (+)
F	Brake (-)

CONNECTION BASE OF AN "INCREMENTAL TTL" ENCODER

Reference mark (I0) IOC-17

PIN	SIGNAL
A	A
B	*A
C	+ 5 V DC
D	Ground
E	B
F	*B
G	Z
H	*Z
I	Thermistor
J	Thermistor
K	U
L	*U
M	V
N	*V
O	W
P	*W
Q	Shield + chassis

Note. Their connection bases are viewed from the outside of the motor.

Brake characteristics

FXM motors have an optional brake that applies friction to the shaft. Its purpose is to immobilize or lock vertical axes, not to brake a moving axis. Its main characteristics depending on the type of brake are:

Motor	Holding torque	Power consumption	On/off time	Unlocking voltage margin	Inertia	Mass
Units	N·m (in·lb)	W (HP)	ms	V DC	kg·cm ²	kg (lbf)
FXM1	Mo of the motor	12 (0.016)	19/29	22-26	0.38	0.3 (0.66)
FXM3	Mo of the motor	16 (0.021)	20/29	22-26	1.06	0.6 (1.32)
FXM5	Mo of the motor	18 (0.024)	25/50	22-26	3.60	1.1 (2.42)
FXM7	Mo of the motor	35 (0.047)	53/97	22-26	31.80	4.1 (9.03)

Note. The maximum speed is 10000 rev/min, for all of them except for the brake that may be used on the FXM7 series that is 8000 rev/min.

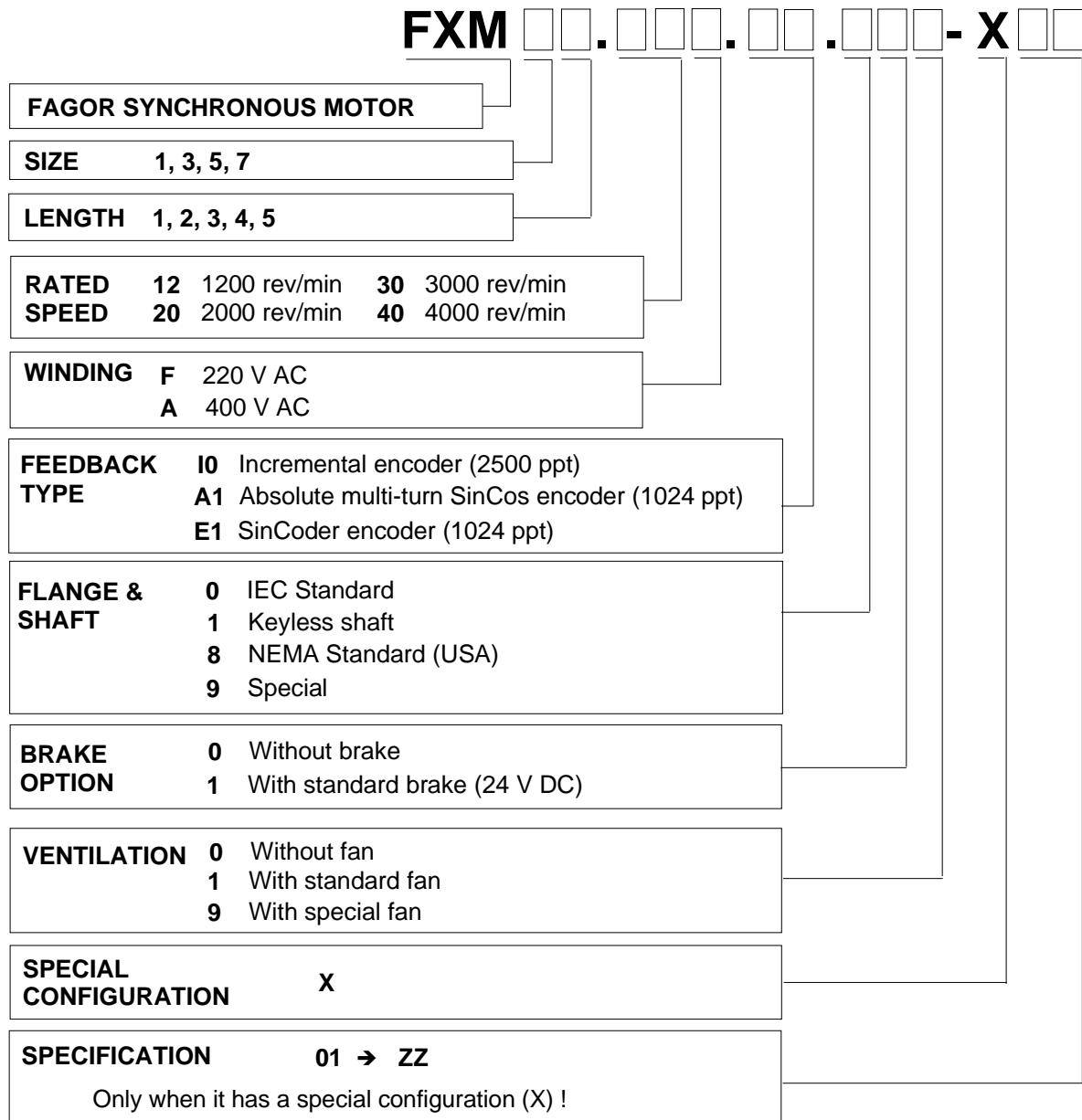


NEVER use this brake to stop a moving axis !



-
- ❑ The brake must never exceed its maximum turning speed.
 - ❑ A voltage between 22 and 26 V DC releases the shaft. Make sure that no voltage over 26 V DC is applied that prevents the shaft from turning.
 - ❑ When installing the motor, make sure that the brake fully releases the shaft before making it turn for the first time.
-

Sales reference



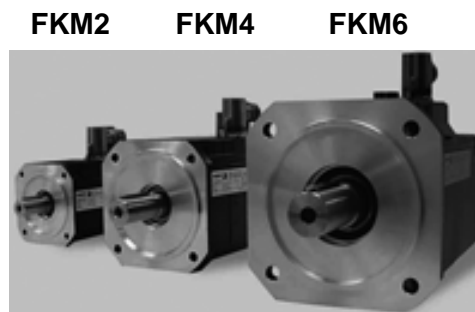
Note: Motor with F type winding may carry an encoder with incremental I0. The rest of feedback devices with only be available on motors with A type winding.

BRUSHLESS AC MOTORS, FKM

Introduction

FKM synchronous servo motors are AC brushless with permanent magnets.

They are ideal for any application requiring great positioning accuracy. They have a uniform output torque, high reliability and low maintenance.



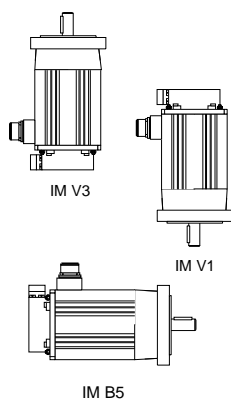
Its normal protection level is IP 64, being immune to liquids and dirt.

They have a KTY84-130 sensor to monitor the internal temperature.

They also carry an optional electromechanical brake.

They have rotating power and feedback connectors.

Meaning of the codes for the mounting method:



Excitation	Permanent rare earth magnets (Nd-Fe-B)
Temperature sensor	Thermistor PTC KTY84-130
Shaft end	Cylindrical keyless (option: with keyway)
Mounting	Face flange with through holes
Mounting method	IM B5, IM V1, IM V3 (as per IEC-34-3-72)
Mechanical	Normal class (meets IEC-72/1971)
Balancing	Class N (Class R optional) meets DIN 45665 Half-key balancing
Roller bearings' life	20000 hours
Noise	DIN 45635
Vibration resistance	Withstands 1g along the shaft and 3g sideways. Take $g=10 \text{ m/s}^2$.
Electrical insulation	Heating class F (150°C~ 302°F)
Insulation resistance	500 V DC, 10 MΩ or greater
Dielectric rigidity	1500 V AC, 1 minute
Protection degree	IP 64 standard configuration; IP 65 with oil seal
Storage temperature	From -20°C to +80°C (- 4°F to 176°F)
Ambient humidity	From 0°C to +40°C (32°F to 104°F)
Ambient temperature	From 20 % to 80 % (non condensing)
Brake	Optional in all models. See section: "brake characteristics"
Feedback	Incremental TTL (FKM with F winding) SinCos™ or SinCoder™ (FKM with A winding)

IP 64 means that it is protected against dust and against water jets. The F class isolation on the motor maintains the dielectric properties as long as the work temperature stays below 150°C (302°F).

Non-ventilated motors	Stall torque	Stall peak torque	Rated speed	Stall current	Peak current	Power	Torque constant	Acceleration time	Inductance per phase	Resistance per phase	Inertia ^{1/}	Mass ^{2/}	Peak torque		
	Mo Nm	Mp Nm	nN rev/min	Io Arms	Imax Arms	Pow kW	Kt Nm/Arms	tac ms	L mH	R Ω	J kg·cm ²	M kg	MCP-10L Nm	MCP-20L Nm	MCP-30L Nm
FKM21.60F.□□.□□□□	1.7	7	6000	4.7	19	1.1	0.36	14.4	2.6	0.885	1.6	4.2	3.6	7.0	
FKM22.30F.□□.□□□□	3.2	13	3000	4.5	18	1.0	0.74	7.0	4.6	1.100	2.9	5.3	7.4	13.0	
FKM22.50F.□□.□□□□	3.2	13	5000	7.2	29	1.7	0.45	11.7	1.7	0.425	2.9	5.3	3.6	9.0	13.0
FKM42.30F.□□.□□□□	6.3	25	3000	8.5	34	2.0	0.74	10.7	2.6	0.450	8.5	7.8		14.8	22.2
FKM42.45F.□□.□□□□	6.3	25	4500	12.4	50	3.0	0.51	16.0	1.2	0.210	8.5	7.8		18.2	25.0
FKM44.30F.□□.□□□□	11.6	47	3000	15.6	62	3.6	0.74	11.2	1.2	0.150	16.7	11.7			22.2
FKM62.30F.□□.□□□□	8.9	35	3000	13.1	52	2.8	0.68	14.4	2.1	0.225	16.0	11.9			20.4
FKM62.40F.□□.□□□□	8.9	35	4000	16.4	66	3.7	0.54	19.1	1.3	0.180	16.0	11.9			16.2
FKM64.20F.□□.□□□□	16.5	66	2000	14.3	57	3.4	1.15	9.4	2.7	0.200	29.5	17.1			34.5
FKM64.30F.□□.□□□□	16.5	66	3000	20.0	80	5.1	0.82	14.0	1.3	0.145	29.5	17.1			24.6
FKM66.20F.□□.□□□□	23.5	94	2000	19.2	76.8	4.9	1.22	9.57	0.8	0.135	43.0	22.3			36.6

1/ Motor inertia without brake.

2/ Motor mass without brake.

Note: The drive recommended to govern each motor must supply the rated current needed to obtain the rated torque from the motor.

Characteristics table of non-ventilated FKM motors with “F” winding (220 V AC)

Non-ventilated motors	Stall torque Mo Nm	Stall peak torque Mp Nm	Rated speed nN rev/min	Stall current Io Arms	Peak current Imax Arms	Power Pow kW	Torque constant Kt Nm/Arms	Acceleration time tac ms	Inductance per phase L mH	Resistance per phase R Ω	Inertia 1/ J kg-cm ²	Peak torque	
												MCP-08H Nm	MCP-16H Nm
FKM21.60A.□□.□□□□	1.7	7	6000	2.8	11	1.1	0.6	14.4	7.7	2.60	1.6	5.0	7.0
FKM22.30A.□□.□□□□	3.2	13	3000	2.4	10	1.0	1.3	7.0	16.0	3.95	2.9	10.2	13.0
FKM22.50A.□□.□□□□	3.2	13	5000	4.0	16	1.7	0.8	11.7	5.8	1.40	2.9	6.7	13.0
FKM22.60A.□□.□□□□	3.2	13	6000	4.5	18	2.0	0.7	14.0	4.6	1.10	2.9	5.6	11.2
FKM42.30A.□□.□□□□	6.3	25	3000	4.6	19	2.0	1.4	10.7	8.6	1.45	8.5		21.9
FKM42.45A.□□.□□□□	6.3	25	4500	6.9	28	3.0	0.9	16.0	3.9	0.675	8.5		14.6
FKM42.60A.□□.□□□□	6.3	25	6000	8.5	34	3.9	0.7	21.3	2.6	0.45	8.5		11.2
FKM44.30A.□□.□□□□	11.6	47	3000	8.2	33	3.6	1.4	11.2	4.2	0.54	16.7		22.6
FKM44.40A.□□.□□□□	11.6	47	4000	10.7	43	4.9	1.1	14.9	2.4	0.315	16.7		17.3
FKM62.30A.□□.□□□□	8.9	35	3000	7.1	28	2.8	1.3	14.4	7.2	0.77	16.0		20.0
FKM62.40A.□□.□□□□	8.9	35	4000	9.3	37	3.7	1.0	19.1	4.1	0.44	16.0		15.4
FKM64.30A.□□.□□□□	16.5	66	3000	12.1	48	5.2	1.4	14.0	3.8	0.285	29.5		21.8
FKM66.20A.□□.□□□□	23.5	94	2000	10.5	42	4.9	2.2	9.5	4.6	0.315	43.0		35.2

1/ Motor inertia without brake.

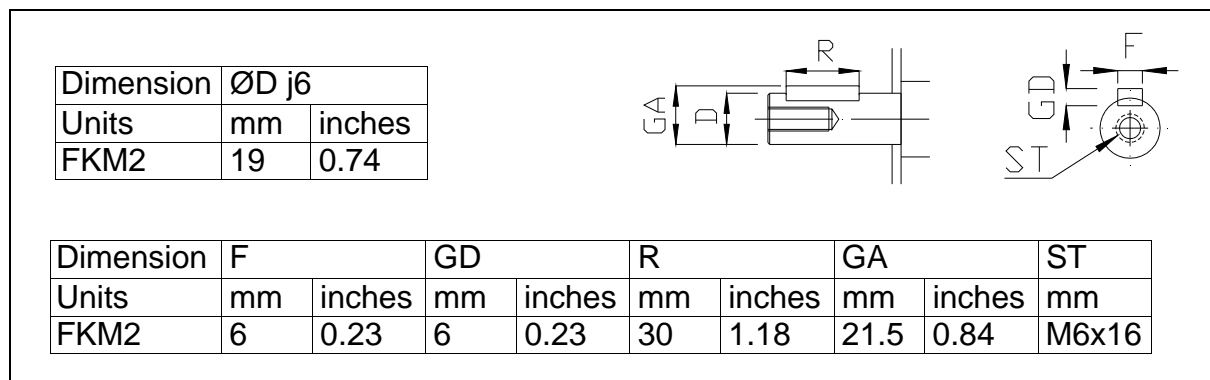
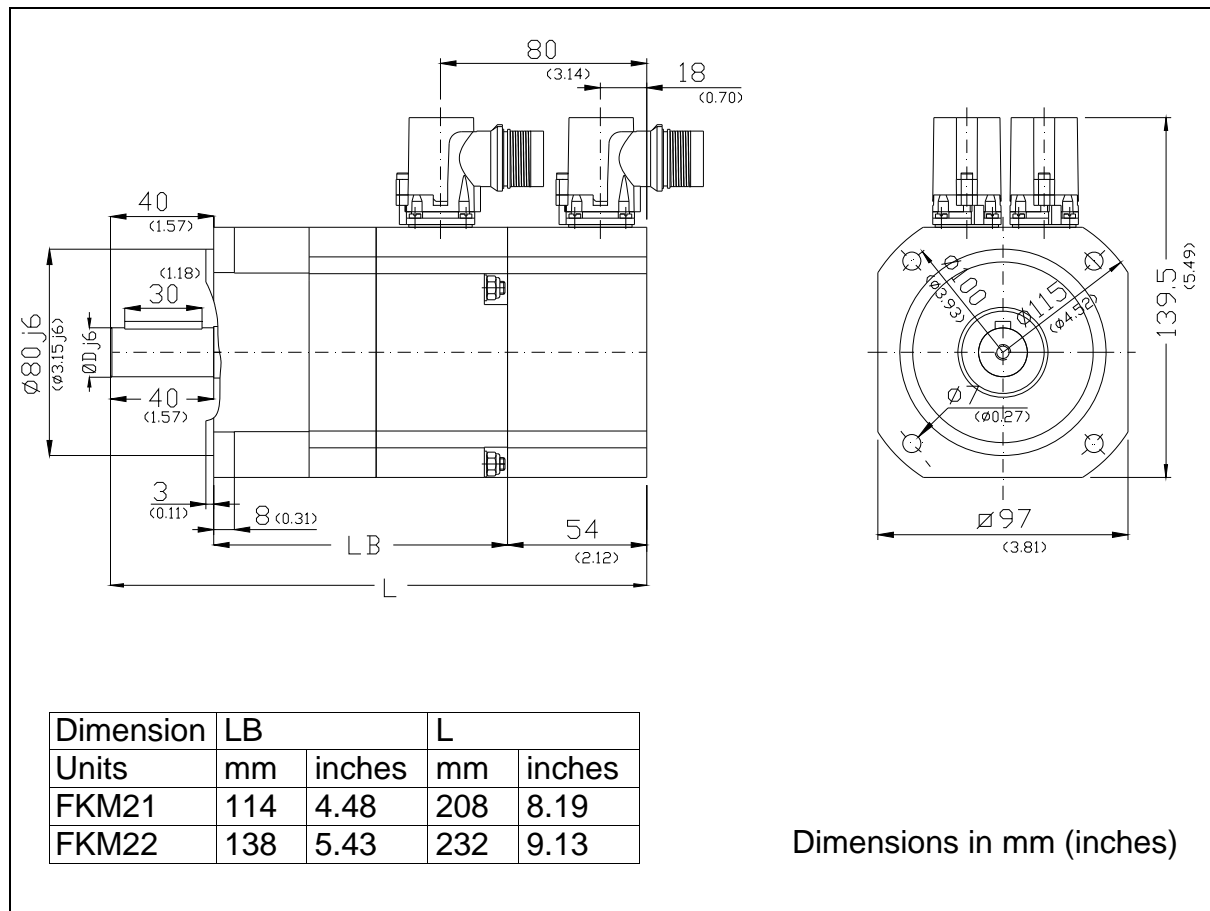
2/ Motor mass without brake.

Note: The drive recommended to govern each motor must supply the rated current needed to obtain the rated torque from the motor.

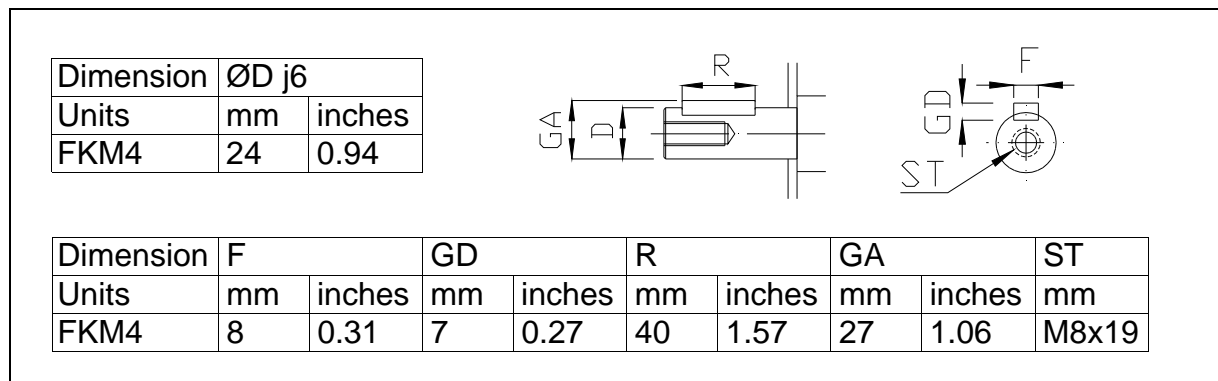
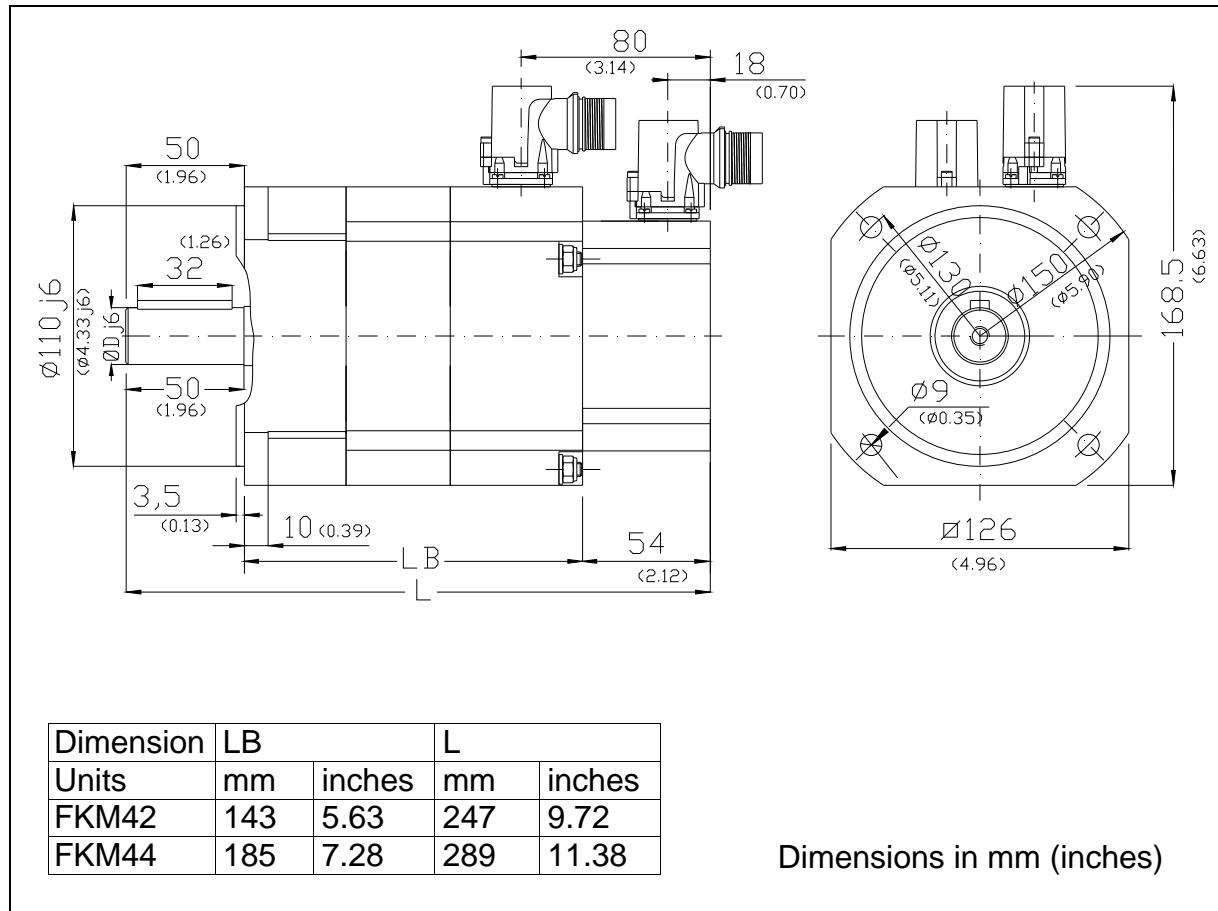
Characteristics table of non-ventilated FKM motors with "A" winding (400 V AC)

Dimensions

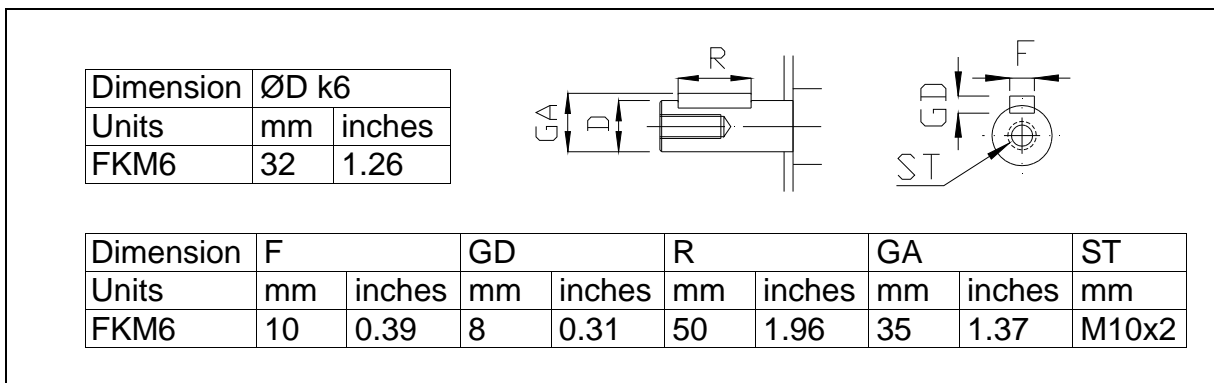
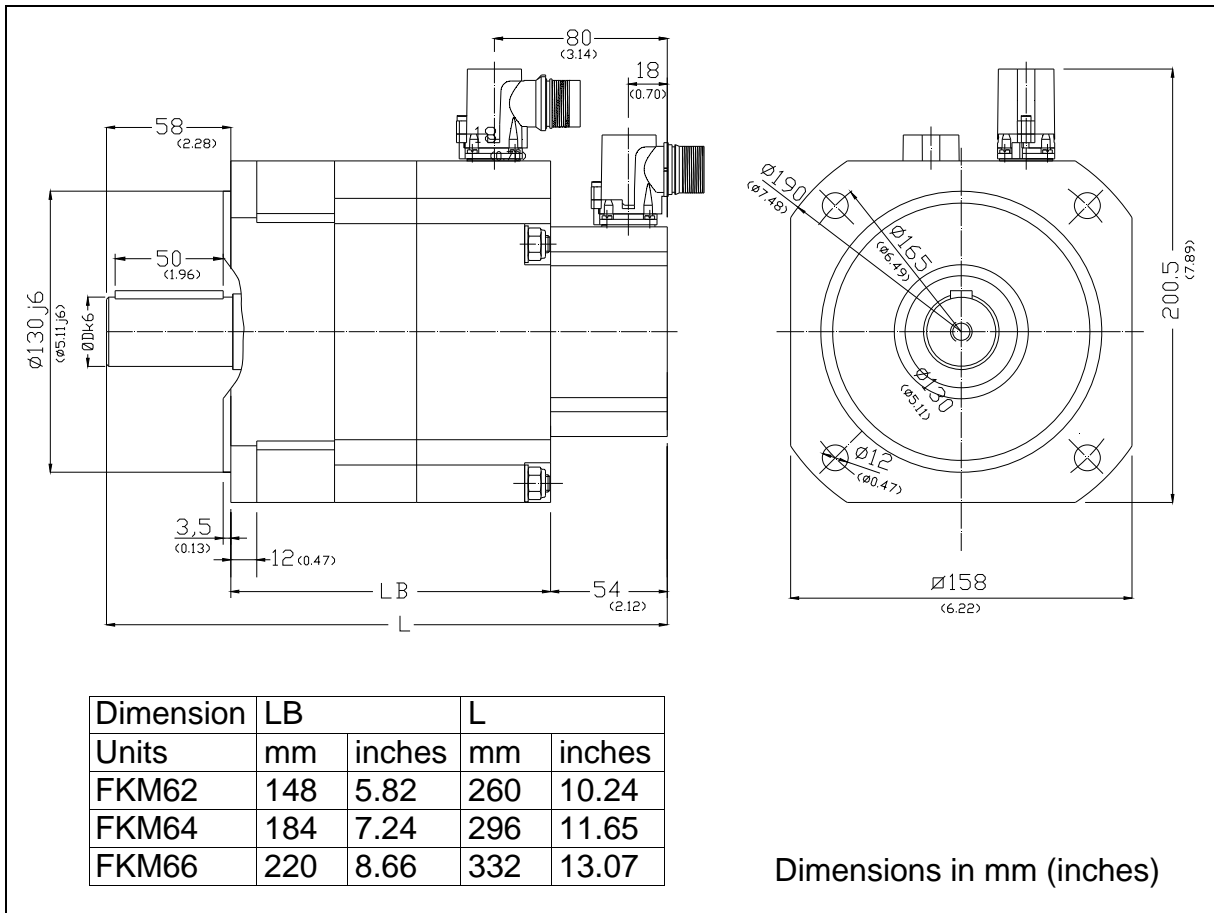
FKM2 series



FKM4 series



FKM6 series

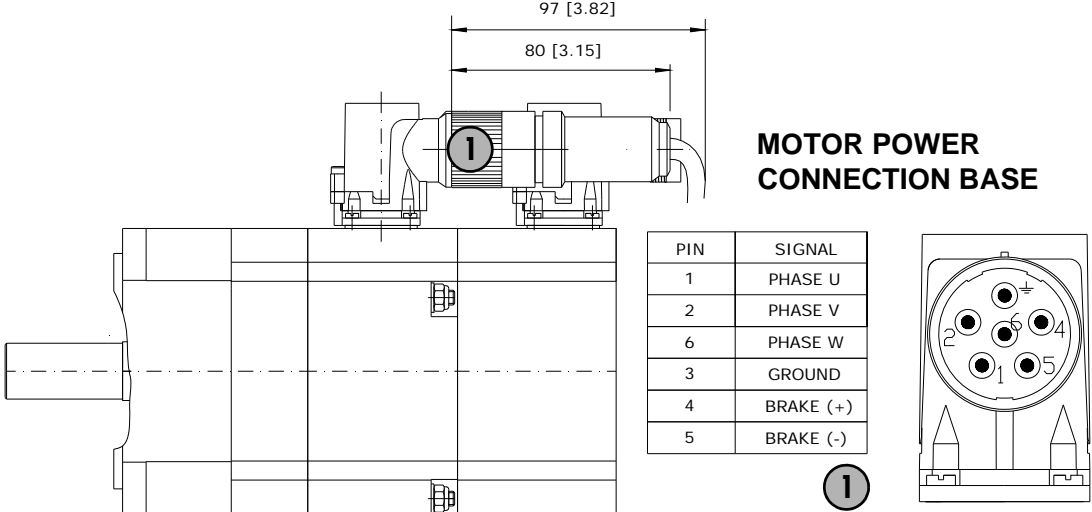


Power connectors and encoder output

It includes the connectors of the brake itself (pins 4 and 5). A voltage between 22 and 26 V DC releases the shaft. When installing the motor, verify that the brake releases the shaft completely before turning it for the first time.

Connecting the motor windings in the order indicated on the connector (U, V, W), the shaft will turn clockwise (CWR, clockwise rotation).

Pins 3 and 4 of the encoder connector correspond to the thermistor PTC KTY84-130 for monitoring motor temperature.

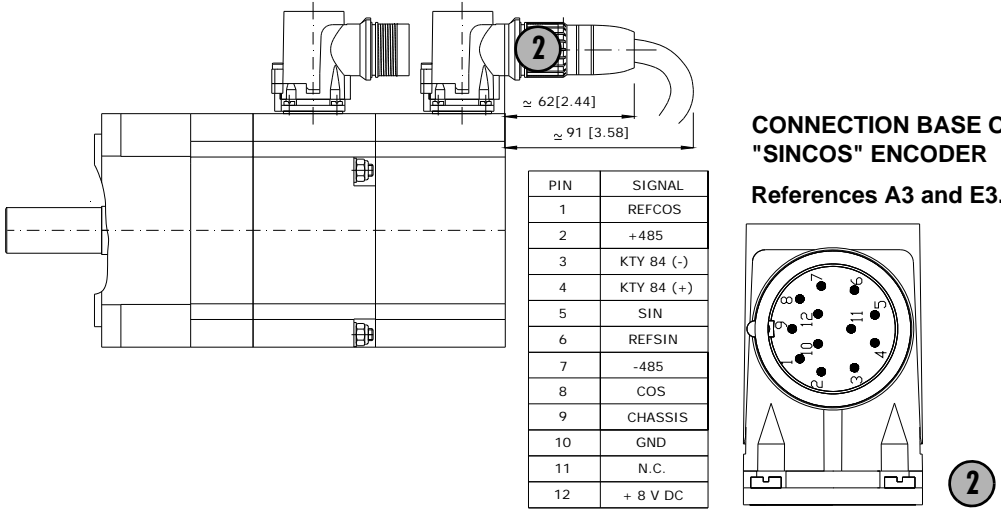


MOTOR POWER CONNECTION BASE

PIN	SIGNAL
1	PHASE U
2	PHASE V
6	PHASE W
3	GROUND
4	BRAKE (+)
5	BRAKE (-)

Note. Their connection base is viewed from the outside of the motor.

POWER CONNECTOR	Example:	MC - 20/6
MOTOR CONNECTOR	MC-20/6	Straight
CURRENT		20 A



CONNECTION BASE OF A "SINCOS" ENCODER
References A3 and E3.

PIN	SIGNAL
1	REFCOS
2	+485
3	KTY 84 (-)
4	KTY 84 (+)
5	SIN
6	REFSIN
7	-485
8	COS
9	CHASSIS
10	GND
11	N.C.
12	+ 8 V DC

Note. Their connection base is viewed from the outside of the motor.

Brake characteristics

FKM motors have an optional brake that applies friction to the shaft. Its purpose is to immobilize or lock vertical axes, not to brake a moving axis. Its main characteristics depending on the type of brake are:

Motor	Holding torque	Power consumption	On/Off time	Unlocking voltage margin	Inertia	Mass
Units	N·m (in·lb)	W (HP)	ms	V DC	kg·cm ²	kg (lbf)
FKM2	4.5 (39.8)	12 (0.016)	7/35	22-26	0.12	0.28 (0.62)
FKM4	9.0 (79.6)	18 (0.024)	7/40	22-26	0.54	0.46 (1.01)
FKM6	18 (159.3)	24 (0.032)	10/50	22-26	1.15	0.90 (1.98)

Note. Maximum speed for all of them is 10000 rev/min.



NEVER use this brake to stop a moving axis !



- ❑ The brake must never exceed its maximum turning speed.
- ❑ A voltage between 22 and 26 V DC releases the shaft. Make sure that no voltage over 26 V DC is applied that prevents the shaft from turning.
- ❑ When installing the motor, make sure that the brake fully releases the shaft before making it turn for the first time.

Sales reference

FKM . . . - **K**

FAGOR SYNCHRONOUS MOTOR													
SIZE	2, 4, 6												
LENGTH	1, 2, 4												
RATED SPEED	<table border="0"> <tr> <td>20</td> <td>2000 rev/min</td> <td>45</td> <td>4500 rev/min</td> </tr> <tr> <td>30</td> <td>3000 rev/min</td> <td>50</td> <td>5000 rev/min</td> </tr> <tr> <td>40</td> <td>4000 rev/min</td> <td>60</td> <td>6000 rev/min</td> </tr> </table>	20	2000 rev/min	45	4500 rev/min	30	3000 rev/min	50	5000 rev/min	40	4000 rev/min	60	6000 rev/min
20	2000 rev/min	45	4500 rev/min										
30	3000 rev/min	50	5000 rev/min										
40	4000 rev/min	60	6000 rev/min										
WINDING	<table border="0"> <tr> <td>A</td> <td>400 V AC</td> </tr> <tr> <td>F</td> <td>220 V AC</td> </tr> </table>	A	400 V AC	F	220 V AC								
A	400 V AC												
F	220 V AC												
FEEDBACK TYPE	<table border="0"> <tr> <td>I0</td> <td>Incremental encoder (2500 ppt)</td> </tr> <tr> <td>A3</td> <td>Absolute multi-turn SinCos encoder (1024 ppt)</td> </tr> <tr> <td>E3</td> <td>SinCos encoder (1024 ppt)</td> </tr> </table>	I0	Incremental encoder (2500 ppt)	A3	Absolute multi-turn SinCos encoder (1024 ppt)	E3	SinCos encoder (1024 ppt)						
I0	Incremental encoder (2500 ppt)												
A3	Absolute multi-turn SinCos encoder (1024 ppt)												
E3	SinCos encoder (1024 ppt)												
FLANGE & SHAFT	<table border="0"> <tr> <td>0</td> <td>With keyway (standard)</td> </tr> <tr> <td>1</td> <td>Cylindrical (with no keyway)</td> </tr> <tr> <td>2</td> <td>Shaft with key and seal</td> </tr> <tr> <td>3</td> <td>Keyless shaft with seal</td> </tr> </table>	0	With keyway (standard)	1	Cylindrical (with no keyway)	2	Shaft with key and seal	3	Keyless shaft with seal				
0	With keyway (standard)												
1	Cylindrical (with no keyway)												
2	Shaft with key and seal												
3	Keyless shaft with seal												
BRAKE OPTION	<table border="0"> <tr> <td>0</td> <td>Without brake</td> </tr> <tr> <td>1</td> <td>With standard brake (24 V DC)</td> </tr> </table>	0	Without brake	1	With standard brake (24 V DC)								
0	Without brake												
1	With standard brake (24 V DC)												
CONNECTION	<table border="0"> <tr> <td>0</td> <td>Rotating angle connectors</td> </tr> <tr> <td>1</td> <td>Cable output without connectors</td> </tr> <tr> <td>9</td> <td>Special</td> </tr> </table>	0	Rotating angle connectors	1	Cable output without connectors	9	Special						
0	Rotating angle connectors												
1	Cable output without connectors												
9	Special												
SPECIAL CONFIGURATION	K												
SPECIFICATION	01 → ZZ Only when it has a special configuration (K) !												

Note: Motor with F type winding may carry an encoder with incremental I0. The rest of feedback devices with only be available on motors with A type winding.

A.C. SERVODRIVE

Introduction

The **MCP** servodrive family is a variation of MCS compact speed drives especially designed to cover the needs of simple applications in the Motion Control environment. It has an integrated positioning drive (table mode).

The elements of the positioning drive's table and the drive parameters may be modified from an external element that has a serial interface (RS232, RS485 or RS422) and is based on the communications protocol ModBus (RTU or ASCII).

All drive parameters (except certain exceptions) may be modified on line.

General characteristics

The **MCP** servodrive family has two series depending on the supply voltage they can be connected to:

Thus, we will refer to:

MCP (H series) Supply voltage: 400 V AC

MCP (L series) Supply voltage: 220 V AC

where each of them will have the following models depending on their peak current:

- For the "MCP-xxH" series:
MCP-04H
MCP-08H
MCP-16H
with peak currents of 4, 8 and 16 Arms.
- For the "MCP-xxL" series:
MCP-05L
MCP-10L
MCP-20L
MCP-30L
with peak currents of 5, 10, 20 and 30 Arms.

Hardware interface characteristics

The positioning drive MCP has the same inputs and outputs as the speed drive MCS, although the former also has:

- An opto-coupled digital output "IN POSITION".
- A direct feedback input for an external TTL incremental encoder or for a sinusoidal encoder with Vpp signals.
- One encoder simulator output that could provide up to the same number of encoder pulses of the motor feedback for motors using incremental TTL encoders of 2500 pulses per turn or up to 4096 pulses per turn when using a 1024 ppt Stegmann encoder for motor feedback.

- ❑ A communications connector that may be connected to any serial line: RS232, RS485 or RS422. The communications protocol is the standard ModBus (RTU).
- ❑ A 4-digit status display.
- ❑ One input-output connector with:
 - ❑ 8 opto-coupled outputs at 24V.
 - ❑ 16 dedicated inputs active at 24V:
 - “Right limit switch” input “FW LIMIT“
 - “Left limit switch” input “REV LIMIT“
 - Automatic/manual input “AUTOM/MAN“
 - “START> input
 - “STOP> input
 - Jog speed push-button input + “JOG +“
 - Jog speed push-button input - “JOG -“
 - “RESET> input
 - External “FAST INPUT“
 - Home search cam input “HOMING SW“
 - Home search command input “HOMING“
 - Inputs for selecting the program starting block number “S0, S1, S2, S3, S4“.

Software interface characteristics

The system is programmed in table mode. It is a programming method where the PLC program, the positioning program and Motion Control program are integrated in a single command line. It uses a special syntax that makes programming easier.

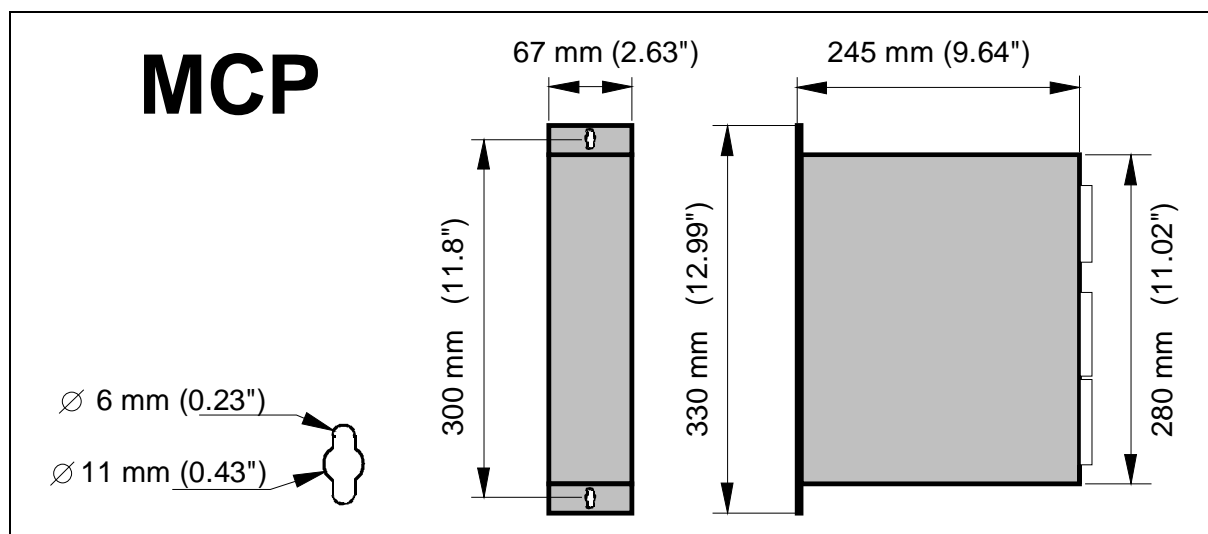
This particular programming syntax has been designed to cover possible applications that could require this equipment.

Types of positioning

The types of positioning that the MCP drive has been designed for are:

- ❑ Linear axes with motor feedback
- ❑ Linear axes with direct feedback
- ❑ Linear axes with both feedback types
- ❑ Rotary axes with motor feedback
- ❑ Rotary axes with direct feedback
- ❑ Rotary axes with both feedback types

Dimensions



Technical data

	220 V - L series -				400 V - H series -		
	05	10	20	30	04	08	16
Rated output current (Arms)	2.5	5	10	15	2	4	8
Peak current (0.5 s) (Arms)	5	10	20	30	4	8	16
Power supply	3 AC 220/240 V ±10% 50/60 Hz ±10%				3 AC 400/460 V ±10%		
Consumption (Arms)	5.6	11.1	22.2	33.3	4.4	8.9	16.7
¹ On single-phase models	¹ 9.5	¹ 18.5					
Over-voltage protection	430 V DC				803 V DC		
Internal ballast (Ω)	112	56	28	18	132	132	66
Power of the int. ballast (W)	150						
Ballast trigger	416 V DC				780 V DC		
Thermal protection of the heatsink	90°C (194°F)						
Operating temperature	5°C / 45°C (41°F / 113°F)						
Storage temperature	- 20°C / 60°C (- 4°F / 140°F)						
Protection degree	IP 20 ^(a)						
Module dimensions	67 x 280 x 245 mm (2.48 x 11.8 x 9.05 inches)						
Module mass	3.85 kg (8.5 lb)						

^(a) IP 20 means that it is protected against objects of a diameter larger than 12.5 mm, but not against water splashes. Therefore, the unit must be mounted inside an electrical cabinet.



Modules MCP-05L and MCP-10L (220 V AC) may be supplied with a single-phase power voltage.

Connectors

Power terminals

POWER INPUTS (L1, L2, L3). Mains input terminals.

POWER OUTPUTS (U, V, W). Output terminals for the voltage applied to the motor. Current control with PWM on a carrier frequency of 8 kHz. When connecting to the motor, watch the matching of phases U-U, V-V and W-W.

L+, Ri, Re. Terminals to configure and connect the external ballast resistor.

CONTROL POWER INPUTS L1, L2, GROUND (X3). Input terminals for the voltage supply of the drive's control circuits from mains. The maximum cable section at these power terminals is **2.5 mm²**. Total isolation between the power and the control circuits.

ACTIVATION OF THE INTERNAL FAN. The internal fan that cools the drive's power elements starts when enabling the Drive Enable signal. The fan will stop when the heatsink temperature is lower 70 °C since the Drive Enable signal is turned off. This method decreases the fan's operating time, thus increasing its useful life.

Control signals

Voltage ±12V, (pins 1, 2, 3 of X1). Output of an internal power supply so the user can easily generate a command signal. It offers a maximum current of 20 mA limited internally.

Velocity command (pins 4, 5 and 6 of X1). Velocity command input for the motor. It admits a range ±10V and offers an impedance of 22 kΩ.

Programmable analog input (pins 4 and 7 of X1). Input of the analog command used by some integrated function. It offers an impedance of 10 kΩ.

Programmable analog output 1 (pins 8 and 10 of X1). Voltage range of ±10 V.

Programmable analog output 2 (pins 9 and 10 of X1). Voltage range of ±10 V. They offer an analog value of a set of internal variables of the drive.

IN POSITION OUTPUT digital output 1, (pins 1 and 2 of X2). Open collector opto-coupled output that reflects the **IN POSITION** output.

❑ **In home search.** Whenever a home search is initiated, the “in-position” signal is deactivated (if it was active). When home search is completed, it activates again.

❑ **In jog mode:**

❑ **Incremental:** It is deactivated every time the switch is pressed and starts moving. The output is activated when the incremental movement is completed.

❑ **Continuous:** It is deactivated when it starts moving and activated when it stops (unless it is due to an error).

❑ **In automatic mode:**

❑ It is activated when the programmed position has been reached (within the range of the in-position window).

❑ It is deactivated when a different movement begins.

Common, (pin 5 of X2). Reference point for the following:

Drive Enable, (pin 4 of X2). At 0 V DC no current can circulate through the motor and it has no torque.

Speed Enable, (pin 3 of X2). At 0V DC, it forces an internal zero velocity command.

These control signals are activated with + 24 V DC.

Drive Ok (pins 6 and 7 of X2). Relay contact that closes when the internal status of the drive control is OK. It must be included in the electrical maneuver.

Programmable digital input (pins 8 and 9 of X2). Digital input that is used as input to some integrated functions (0 and +24V). By default, it is selected as error reset.

Motor feedback input + motor temp. sensor. Input of the encoder signals installed on the motor for position + velocity feedback and of the temperature sensor of the motor.

Auxiliary position input. Direct feedback input.

Encoder simulator output. Outputs of those same encoder signals, divided by the preset factor, for closing the position loop at the CNC.

The maximum cable section at these terminals is 0.5 mm². See the chapter on installation.

RS232/RS422/RS485 communications. Connector used to communicate with other equipment with the RS-232, RS-422 or RS-485 serial line.

Inputs

GND (pin 1 of X5). GND pin, reference for all the signals of connector X5.

S0, S1, S2, S3 and S4 (pins 2, 3, 4, 5 and 6 of X5), respectively: Inputs for selecting the program's starting block number. They are used to select the block number that will be executed when activating START. Active at +24 V and the block number must be in binary format. Reflected mark RG4.

START input (pin 7 of X5). In automatic mode, a +24 V pulse longer than 1 ms at this input initiates the automatic positioning block. Reflected mark LV15.

STOP input (pin 8 of X5). A 0 V pulse longer than 1 ms at this input stops the positioning block, the homing command and the JOG functions.

In positioning-block mode, activating the START input resumes the positioning block as expected.

For homing and JOG functions, it just cancels the command. Reflected mark LV16.

RESET input (pin 9 of X5). In automatic mode and positioning block in execution, a +24 V pulse longer than 1 ms at this input aborts the positioning. When resuming the positioning block, it will be executed again from the beginning. Reflected mark LV17.

AUTO / MAN input (pin 10 of X5). A switch will be connected to this input for selecting between automatic and jog mode. Reflected mark LV13.

0 V	Automatic mode
+ 24 V	Jog mode

"JOG +" input (pin 11 of X5). "Positive Jog" speed push-button input. Selecting the jog mode, applying +24 V input executes the movement in jog mode depending on the value set at the variable: **LV19 <KernelManMode>** (jog mode). **LV19 = 0** sets the continuous jog mode. The value stored in parameter **LP22 <JogVelocity >** (mm/min or °/min) indicates the feedrate value **in the positive direction** at which the axis will move when this input is activated. **LV19 = 1** sets the incremental jog mode. This means that every time this input is activated, it will move **in the positive direction** the distance indicated by parameter **LP23 <JogIncrementalPosition >**. Reflected mark LV20.

"JOG -" input (pin 12 of X5). "Negative Jog" speed push-button input. Its function is the same as the previous input, but it will move **in the negative direction**. Reflected mark LV21.

FW LIMIT input (pin 13 of X5). Input for the right travel limit switch. Activating this input prevents the axis from moving beyond the posi-

tion of this limit switch, but it will be possible to move in the opposite direction.

0 V	Activated
+ 24 V	Deactivated

REV input. LIMIT (pin 14 of X5). Input for the left travel limit switch. Activating this input prevents the axis from moving beyond the position of this limit switch, but it will be possible to move in the opposite direction.

0 V	Activated
+ 24 V	Deactivated

HOMING input (pin 15 of X5). Home search command input; a home search ordering switch may be connected to it. This input is active at +24 V. Reflected command PC148.

HOMING SW input (pin 16 of X5). Home search cam input where the home switch is connected. This input is active depending on PP147.1.

PP147.1 = 0	Positive logic. It is activated with +24 V
PP147.1 = 1	Negative logic. It is activated with 0 V

FAST INPUT input (pin 17 of X5). External Fast IN. A +24 V pulse longer than 1 ms at this input activates the **INIFAST** mark that is interpreted in the positioning table.

Outputs

EXT. +24 V (pin 1 of X6). Input for the external +24 V used to activate the outputs **OUT1 ... OUT8**.

EXT. GND (pin 2 of X6). Input for external ground used to activate the outputs **OUT1 ... OUT8**.

OUT1 ... OUT8 (pins 3, 4, 5, 6, 7, 8, 9 and 10 respectively of X6). Open-emitter outputs, active at +24 V and protected against short-circuits. Load current: 250 mA.

Its status is defined by the value contained in the **PROGOUT** field of the positioning table.

Service

Connector reserved for the exclusive use of Fagor Automation's technicians.

Indicators (led's)

EXT. 24V OK. Indicator located between connectors X5 and X6. It stays lit while external + 24 V are being supplied to the outputs of connector X6.

OUTPUTS OVERCURRENT. Indicator located between connectors X5 and X6. When lit, it indicates that there is a short-circuit in the external cabling of one of the outputs of connector X6. It turns off when the short-circuit disappears. A short-circuit means a current greater than 0.5 A.

CROWBAR (ON). Indicator located to the right of the STATUS display. When lit, it indicates that the voltage of the internal bus has exceeded the preset voltage values and the ballast resistor has been activated.

VBUS OK. Indicator located to the right of the STATUS display. When lit, it indicates that there is power voltage.

STATUS. 7-segment display for displaying the status of the drive and the alarms.

Push buttons

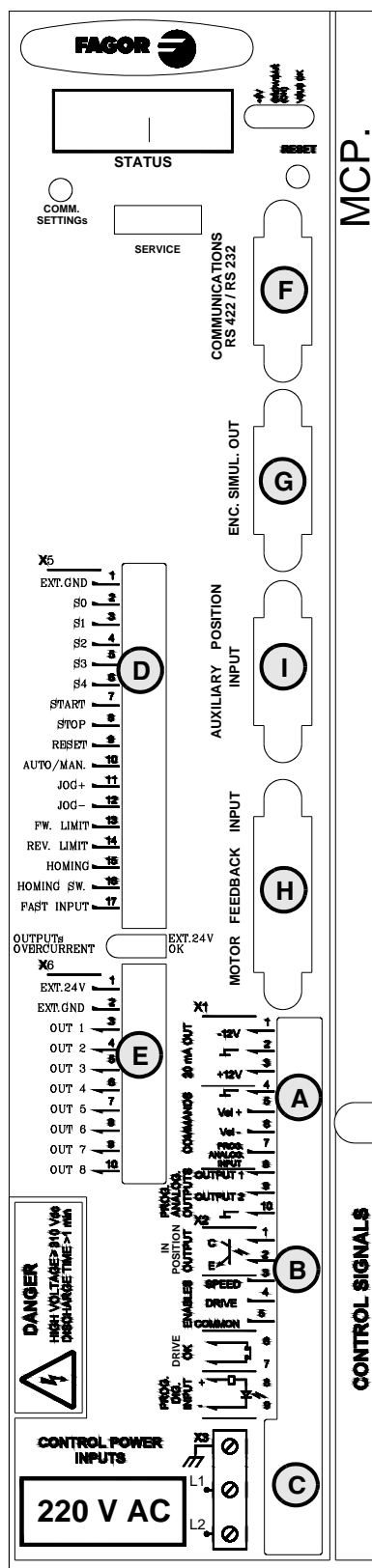
RESET. Push-button for resetting the system.

COMM SETTINGS. Push-button that when activate for more than 5 seconds, automatically configures all the parameters (by default) for serial line communications (Communications RS422/RS232/RS485 connector).

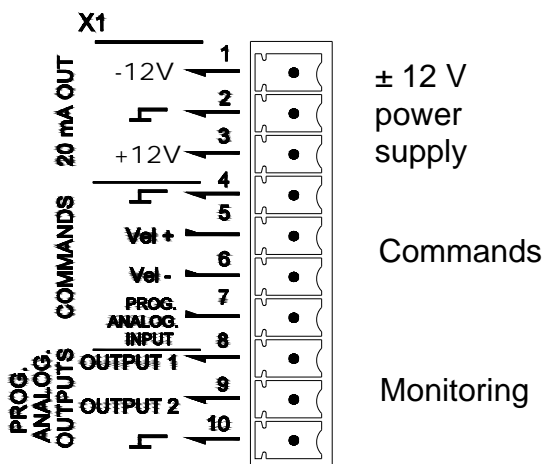
These parameters are:

Speed of 9600 baud, no parity, 8 data bits, 1 stop bit, "Modbus RTU 232" communications protocol and node number 1.

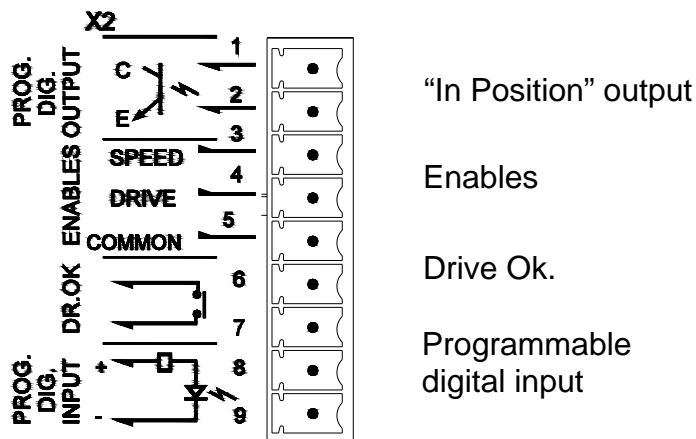
Front panel and pinout of the connectors



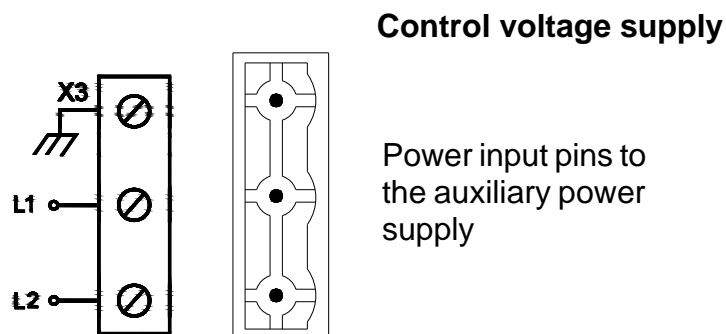
A. CONNECTOR X1



B. CONNECTOR X2

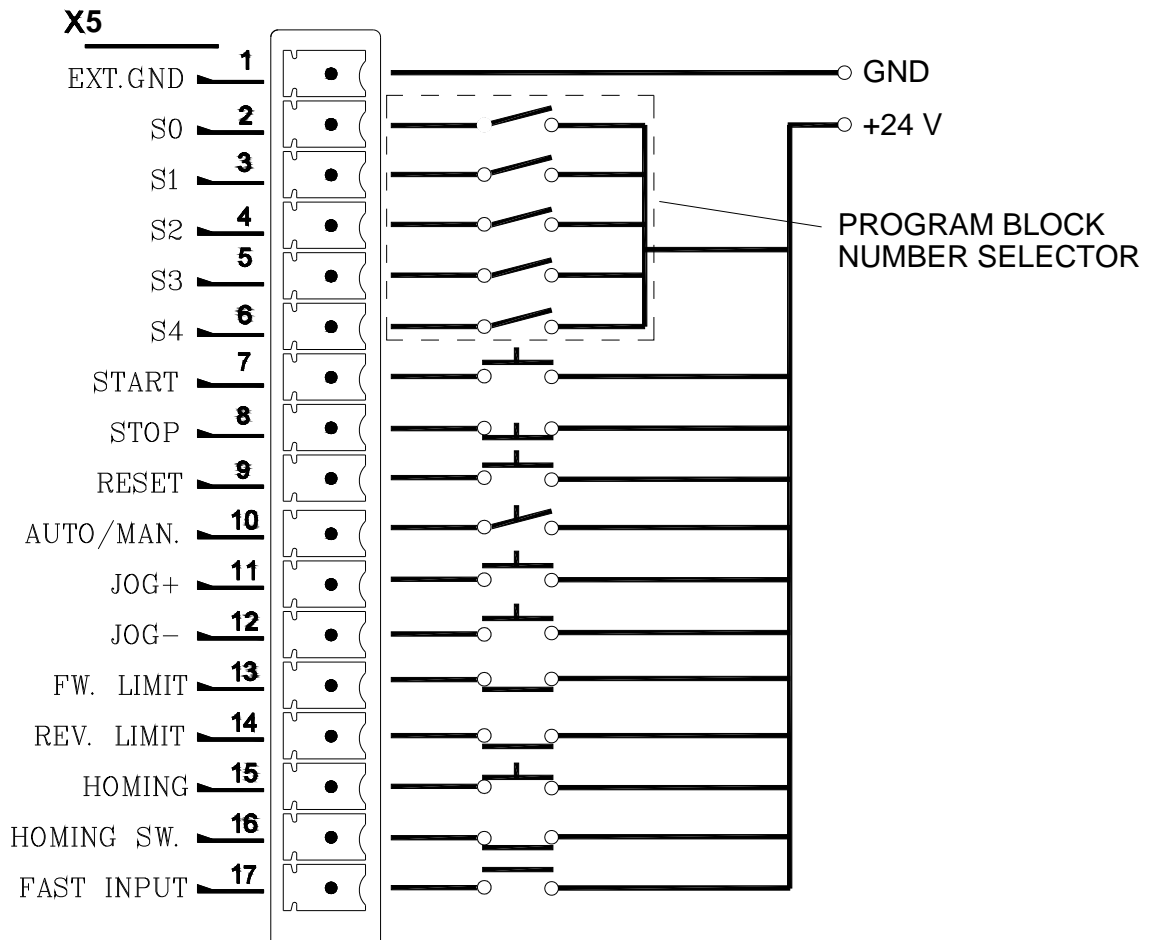


C. CONNECTOR X3

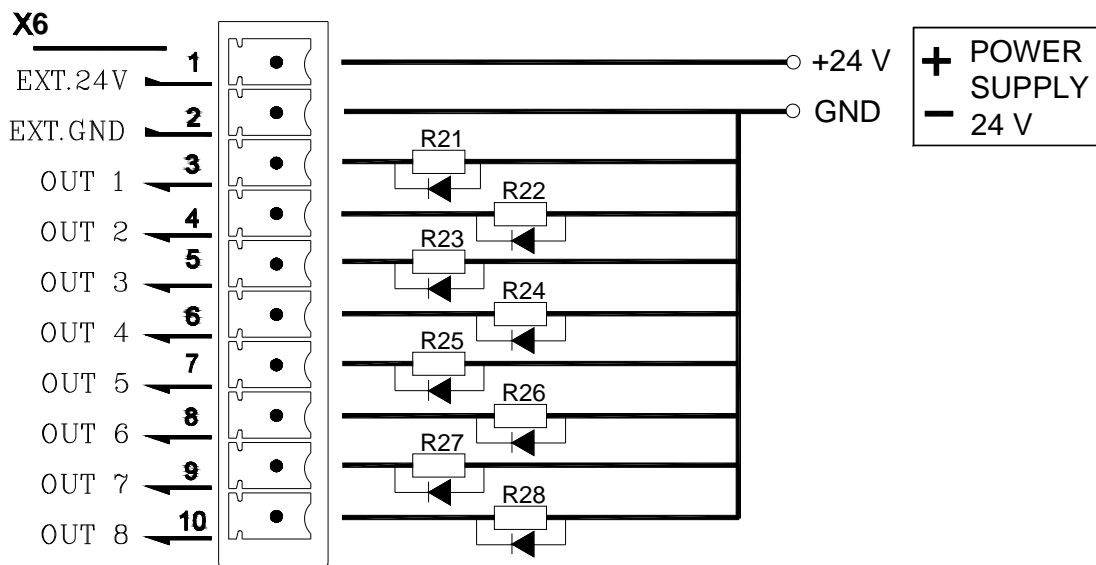


Note that the label 220 V AC will indicate 400 V AC on the corresponding models.

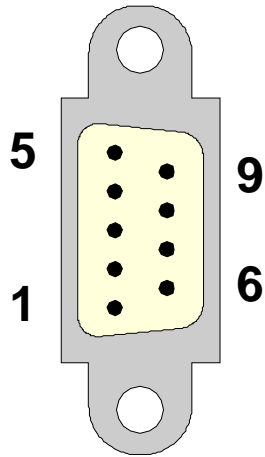
D. CONNECTOR X5



E. CONNECTOR X6

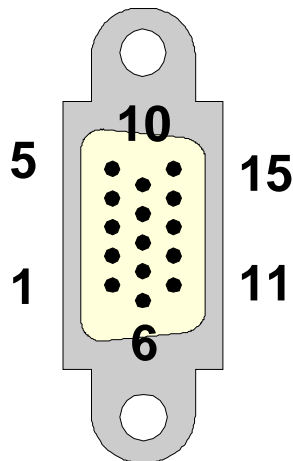


F. COMMUNICATIONS CONNECTOR



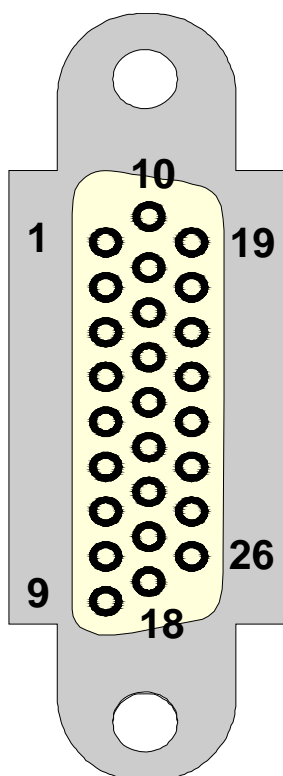
Pin	Signal	Function
1	N.C.	Not connected
2	R x D	R x D (232)
3	T x D	T x D (232)
4	+ 5V	Voltage supply
5	GND	GND
6	T x D+	T x D + (422)
7	T x D -	T x D - (422)
8	R x D+	R x D + (422) T x D / R x D + (485)
9	R x D -	R x D - (422) T x D / R x D - (485)
	CHASSIS	Screws

G. OUTPUT CONNECTOR OF THE ENCODER SIMULATOR



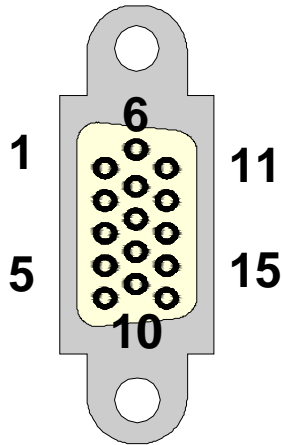
Pin	Signal	Function
1	A+	A + signal
2	A-	A - signal
3	B+	B + signal
4	B-	B - signal
5	Z+	Z + signal
6	Z-	Z - signal
7	+ 485	RS485 serial line transmission signal
8	- 485	
9	N.C.	Not connected
10	N.C.	Not connected
11	GND	0 Volts
12	REFCOS	Cosine signal ref. level
13	COS	Encoder cosine signal
14	REFSIN	Sine signal ref. level
15	SIN	Encoder sine signal
	CHASSIS	Screws

H. INPUT CONNECTOR OF THE MOTOR FEEDBACK & TEMPERATURE SENSOR



Pin	Signal	Function
1	A+	A + signal
2	B+	B + signal
3	Z+	Z + signal
4	U -	Phase switching U -
5	W -	Phase switching W -
6	V -	Phase switching V -
7	N.C.	Not connected
8	N.C.	
9	N.C.	
10	A -	A - signal
11	B -	B - signal
12	Z -	Z - signal
13	U+	Phase switching U +
14	W+	Phase switching W +
15	V+	Phase switching V +
16	N.C.	Not connected
17	SELSEN1	Information of the installed sensor given to the drive via hardware
18	SELSEN2	
19	+ 485	RS485 serial line for SinCos™ encoder or SinCoder™
20	- 485	
21	KTY -	Thermal sensor KTY84-130 of the motor
22	KTY +	
23	+ 8 V	Voltage supply for SinCos™ encoder or SinCoder™
24	+ 5 V	Supply voltage for the incremental encoder
25	GND	0 V
26	CHASSIS	Pin
	CHASSIS	Screws



I. DIRECT FEEDBACK INPUT CONNECTOR



Pin	Signal	Function
1	A+	A+ signal
2	A-	A - signal
3	B+	B+ signal
4	B -	B - signal
5	Z+	Z+ signal
6	Z-	Z - signal
7	+ 485	RS 485 serial line
8	- 485	
9	+ 5 V	Voltage supply
10		
11	GND	Ground
12		
13	N. C.	Not connected
14		
15	CHASSIS	Screws

Characteristics plate

Specs plate that comes with each Fagor MCP digital drive.

FAGOR 		Fagor Automation S. Coop.(Spain) AC SERVODRIVE	
MODEL: MCP -10 L	INPUT : 3 X 220 VAC / 50-60 Hz		
S.N.: 22-01090003			
CTR POT IOs VAR FR xxA xxA xxA xxA	Io 5 A I _{max} 10 A	W: 3,8 kg	

CTR, POT, IO, VAR and FR indicate manufacturing related aspects (hardware design versions) that are useful for technical consultations and repairs.

Sales reference

Codes of the **sales reference** of MCP Fagor drives.

MCP DIGITAL DRIVE		Example: MCP -		05	L
MODEL	MCP				
CURRENT		Rated	Peak (0.5 s)		
	05	2.5 A	5 A		
	10	5 A	10 A		
	20	10 A	20 A		
	30	15 A	30 A		
SUPPLY VOLTAGE			220 V AC	L	

MCP DIGITAL DRIVE		Example: MCP -		04	H
MODEL	MCP				
CURRENT		Rated	Peak (0.5 s)		
	04	2 A	4 A		
	08	4 A	8 A		
	16	8 A	16 A		
SUPPLY VOLTAGE			400 V AC		

INSTALLATION

General considerations

At the motor

Remove the anti-corrosion paint of the shaft before mounting them on to the machine. The motor may be mounted as IM B5, IM V1 and IM V3.

Watch for the ambient conditions mentioned in the section on general characteristics and also:

- ❑ Mount it somewhere that is dry, clean and accessible for maintenance.

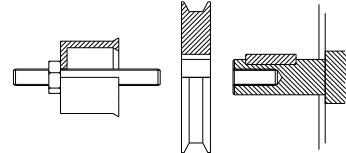
Remember that the degree of protection is IP 64.

- ❑ It must be easily cooled.
- ❑ Avoid corrosive or flammable environments.
- ❑ Guard the motor with a cover if it is exposed to splashes.
- ❑ Use flexible coupling for direct transmission.
- ❑ Avoid radial and axial loads on the motor shaft.



WARNING: Do not hit the shaft when installing transmission pulleys or gears!

Use some tool that is supported in the threaded hole on the shaft to insert the pulley or the gear.

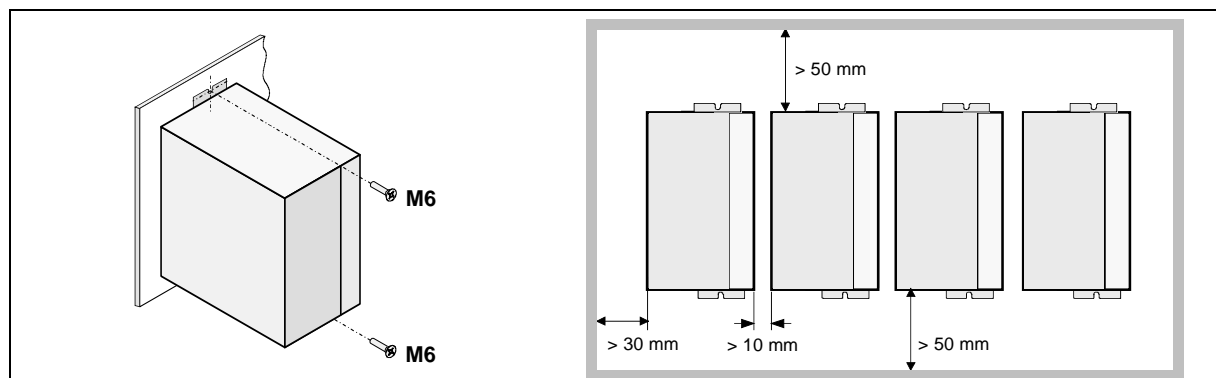


At the drive

The module must be installed in an electrical cabinet that is clean, dry, free of dust, oil and other pollutants.

Remember that the degree of protection is IP 20.

Never install it exposing it to flammable gases. Avoid excessive heat and humidity. The ambient temperature must never exceed 45°C (113°F). Install the modules vertically, avoid vibrations and respect the gaps to allow air flow. See figure.



About the connection

All the cables must be shielded, to reduce the interference on the control of the motor due to the commutation of the PWM.

The shield of the motor power cable must be connected to the chassis screw at the bottom of the module and it, in turn, taken to mains ground.

The command signal lines must be shielded twisted pairs. The shield must be connected to the voltage reference at the module (pins 2, 4 or 10 of X1).

Keep the signal cables away from the power cables.

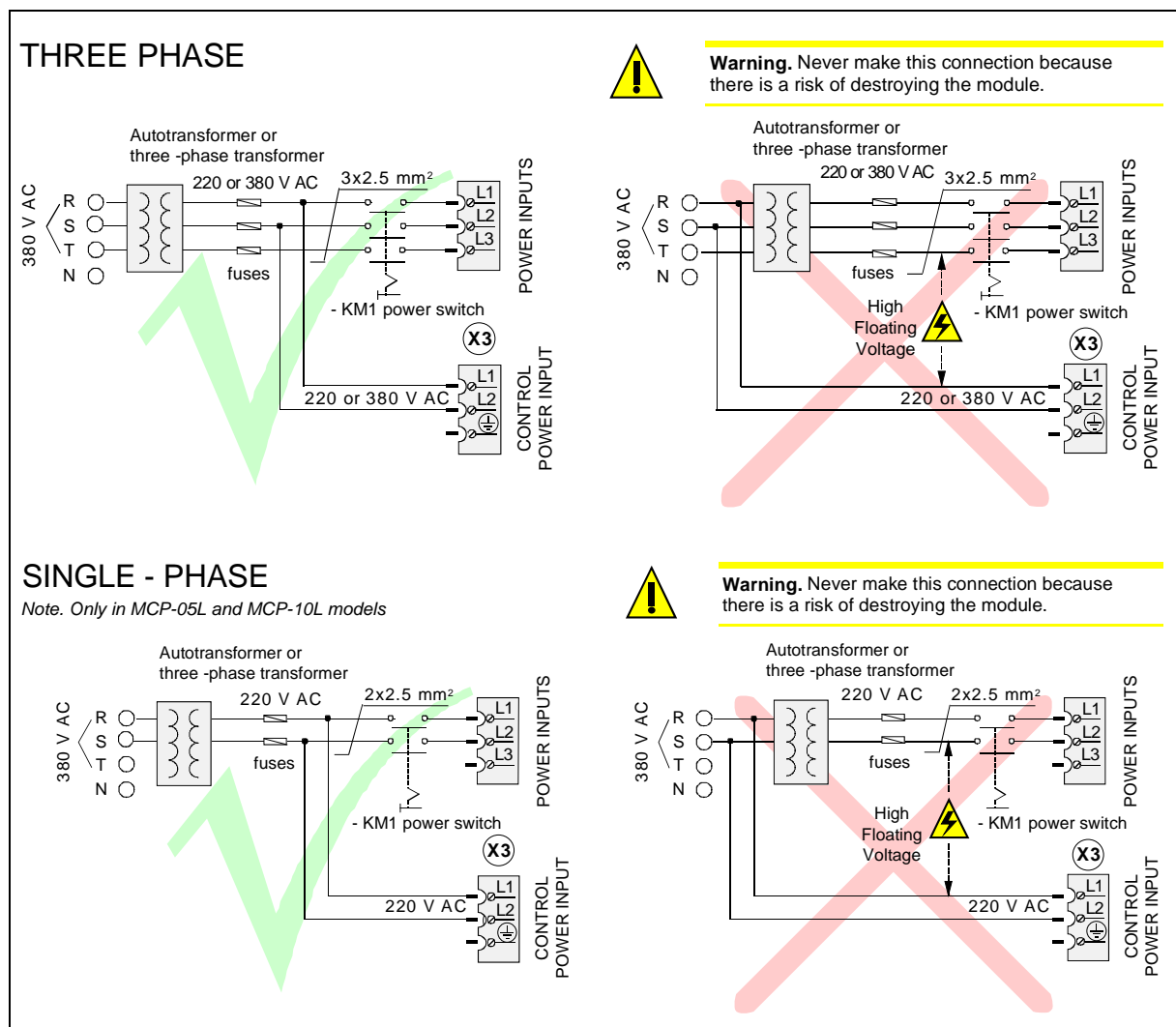
All the pins with the GND symbol (2, 4 and 10) are the same electrical point and are interchangeable.

Electrical connections

Power connection. Mains-Drive

The drive power supply must be three-phase, except in modules MCP-05L and MCP-10L that can also be single-phase. See parameter GP16.

The use of a transformer is not a must.



The table below shows the values recommended for the fuses shown in the previous figure. They are slow general purpose fuses. If they are installed on the Mains input lines, their maximum currents will depend on the value of the mains voltage.

Model	Peak current (Arms)	Fuse (A)
MCP-05L	05	04
MCP-10L	10	08
MCP-20L	20	16
MCP-30L	30	25
MCP-04H	04	04
MCP-08H	08	08
MCP-16H	16	16

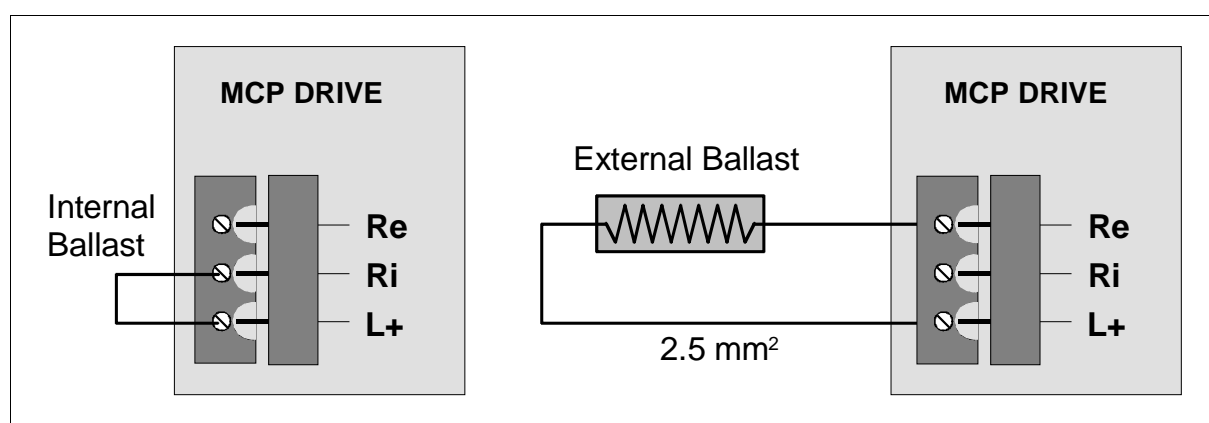
Note. A thermal switch may optionally replace the fuses.

Important. The secondary windings must have a star connection with its middle point connected to ground.

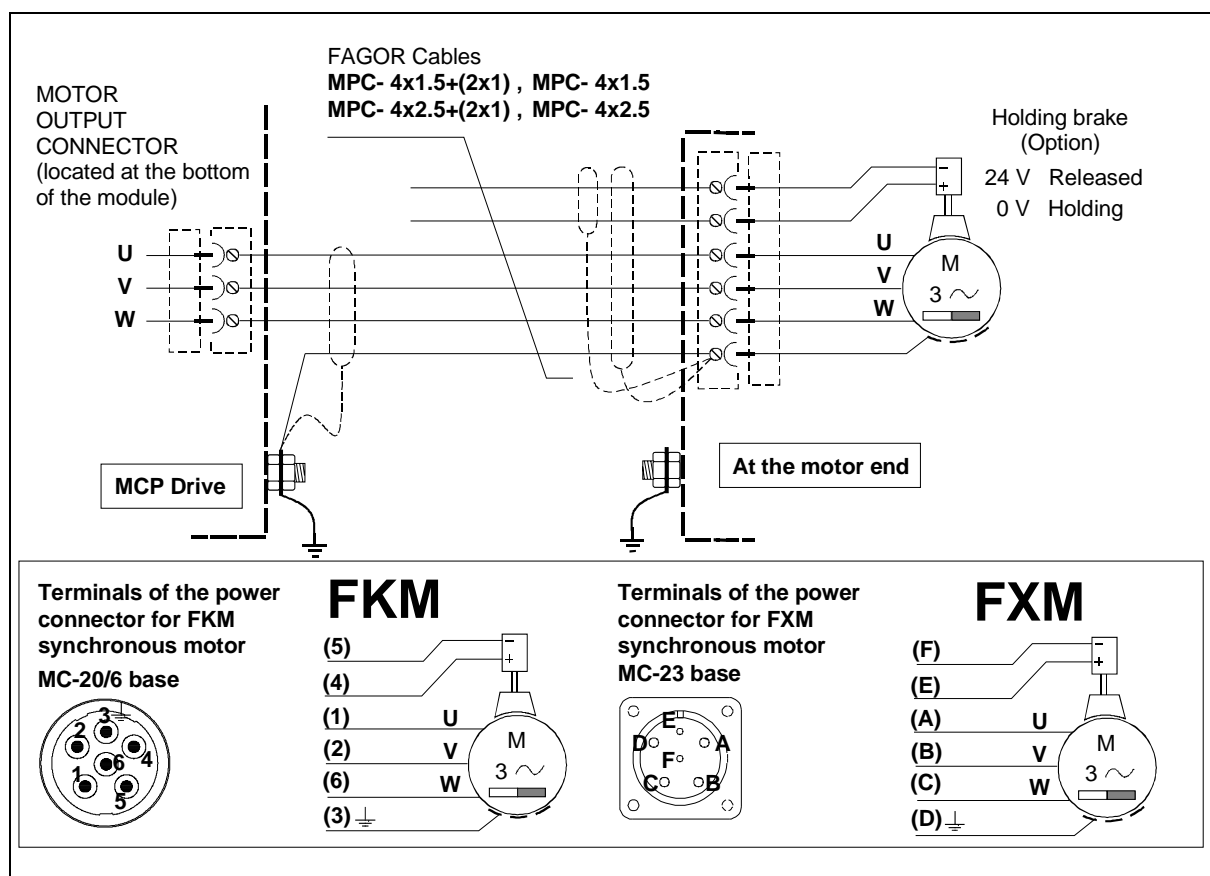
Power connection. External Ballast resistor

If the application requires a Ballast resistor with more than 150 W:

- ❑ Remove the cable joining the terminals **Ri** and **L+**.
- ❑ Install the external resistor between the terminals **Re** and **L+**.
- ❑ Make sure that the resistance (Ohms) of the external ballast resistor is the same as that of the internal resistor of that module. See the value in the technical data table.
- ❑ Use KV41 to indicate to the drive that an external ballast resistor has been connected.



Power connection. Drive-motor

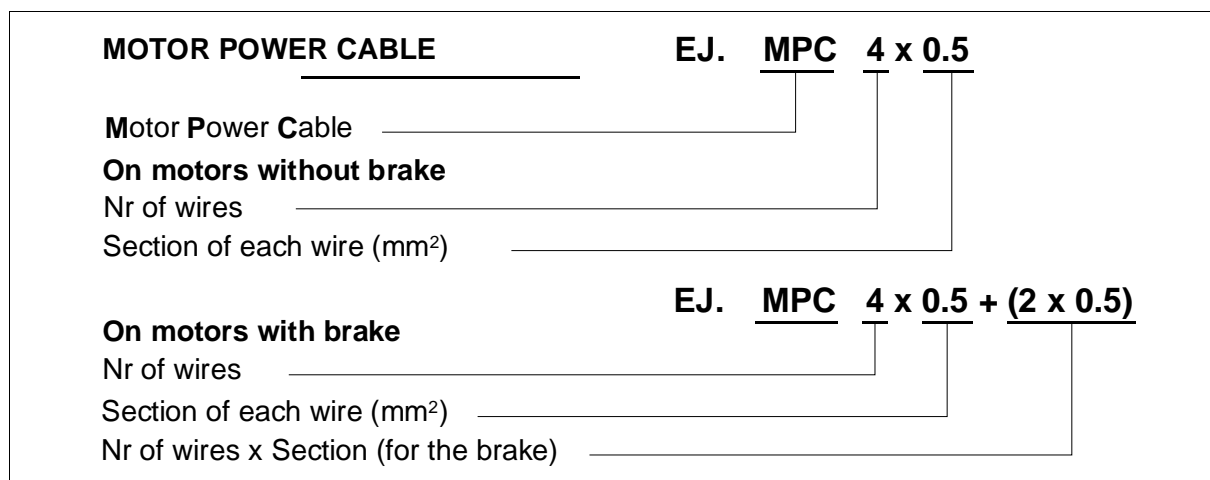


Power cables

If the motor does not have a	If the motor has a brake
MPC-4x1.5	MPC-4x1.5+(2x1)
MPC-4x2.5	MPC-4x2.5+(2x1)

Note. The length of the MPC power cable must be specifically ordered (in meters).

Codes of the **sales reference** of Fagor power cables.



Connection of the monitoring and control signals

Enable signals using ± 12 V voltage

Drive OK switch

Drive OK contact	0.6 A - 125 V AC
	0.6 A - 110 V DC
	2 A - 30 V DC

Enable signals

Monitoring signals

Programmable digital outputs

Maximum current	100 mA
Maximum voltage	50 V

Programmable digital input

Encoder feedback connection

The signals generated by the encoder are taken to the ENCODER INPUT of the MCP drive. The MCS amplifies these signals and may divide their frequency. The division factor is given by the values of parameter EP1 (see later on) and the sequence between A and B by parameter EP3. The MCP drive offers these signals by the connector ENC. SIMUL. OUT. The encoder must be mounted on to the motor shaft and cannot be installed anywhere else in the transmission chain.

The encoders that can be found on the motors depending on the series are:

At FXM servo motors
I0. Incremental TTL encoder (2500 ppt)
E1. SinCoder™ encoder (1024 ppt)
A1. Multi-turn SinCos™ encoder (1024 ppt)
At FKM servo motors
I0. Incremental TTL encoder (2500 ppt)
E3. SinCos™ encoder (taper shaft) (1024 ppt)
A3. Multi-turn SinCos™ encoder (1024 ppt)

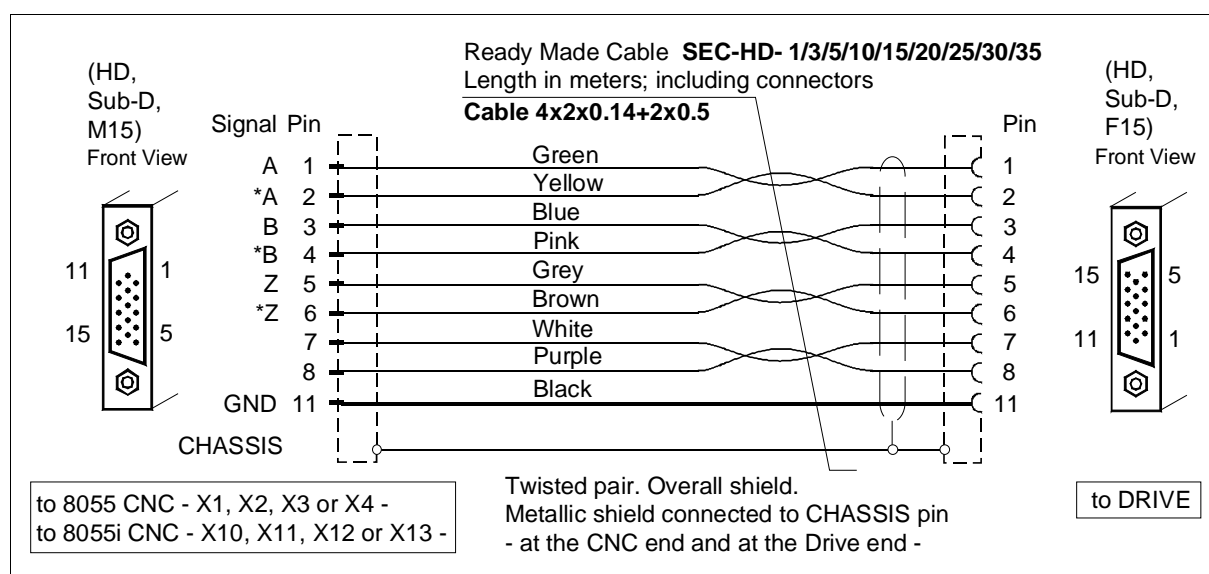
With motor feedback E1 or E3, the output of the encoder simulator multiplies by 4 the number of pulses of the encoder (1024x4=4096 ppt). This (4096) is the highest value to be set in EP1. Note that it may be programmed (it is not a fixed value).

Cabling

Fagor provides these full connections (cables + connectors): **SEC- HD, IECD, EEC, EEC-SP.**

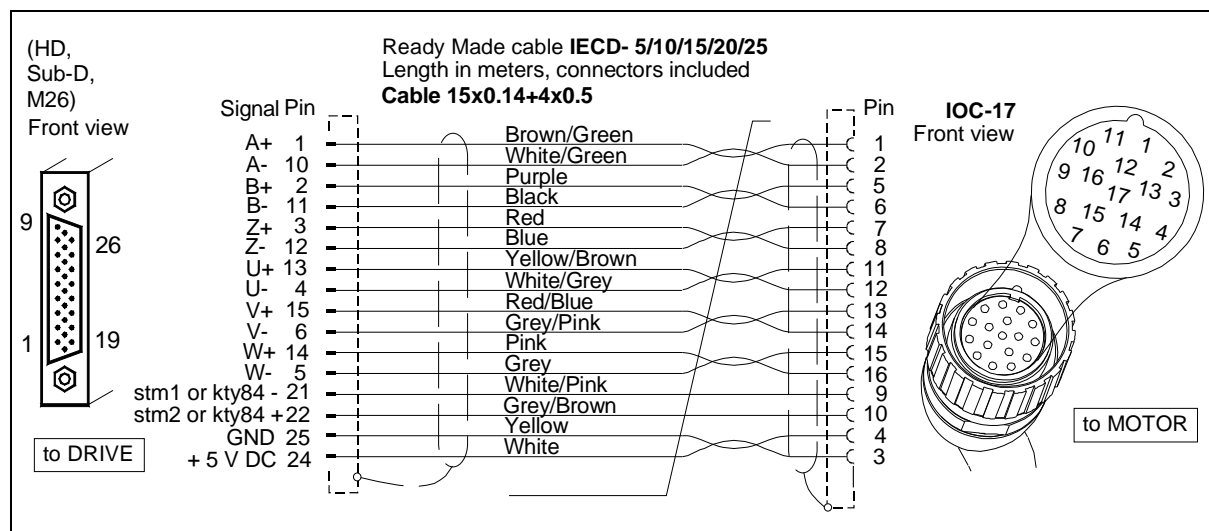
Encoder simulator connecting cable, SEC-HD

Depending on motor feedback, the drive can generate a set of signals that simulate those of a TTL encoder attached to the rotor of the motor. The SEC-HD cable transfers these signals from the drive to the 8055/55i CNC.



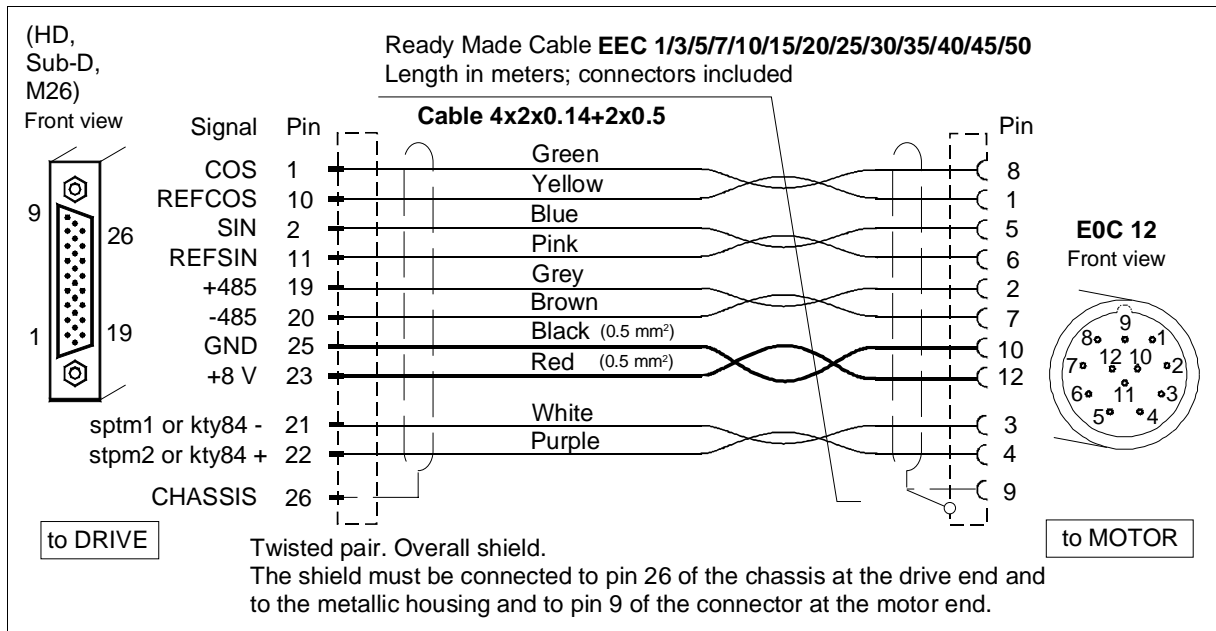
TTL encoder connecting cables, IECD

The IECD cable transfers the motor feedback signals from the incremental TTL encoder to the drive.



Sinusoidal encoder connecting cable, EEC

The EEC cable transfers the motor feedback signals from the sinusoidal encoder to the drive. It has overall shield and twisted pairs.

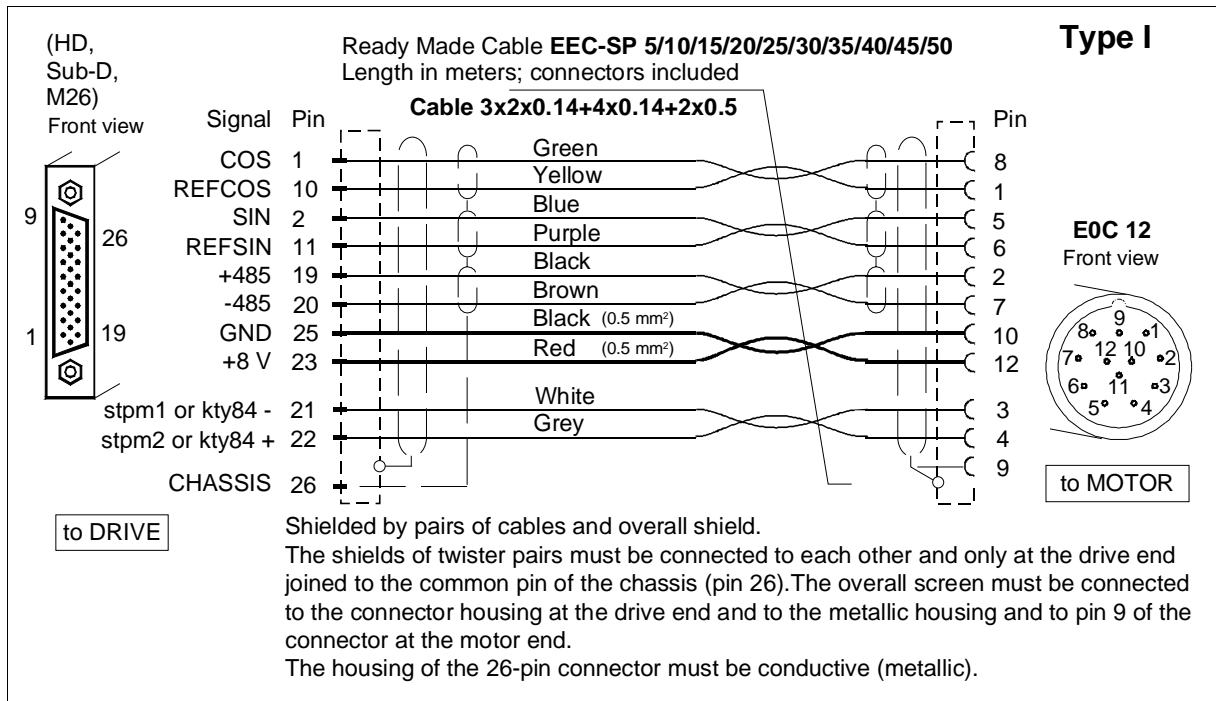


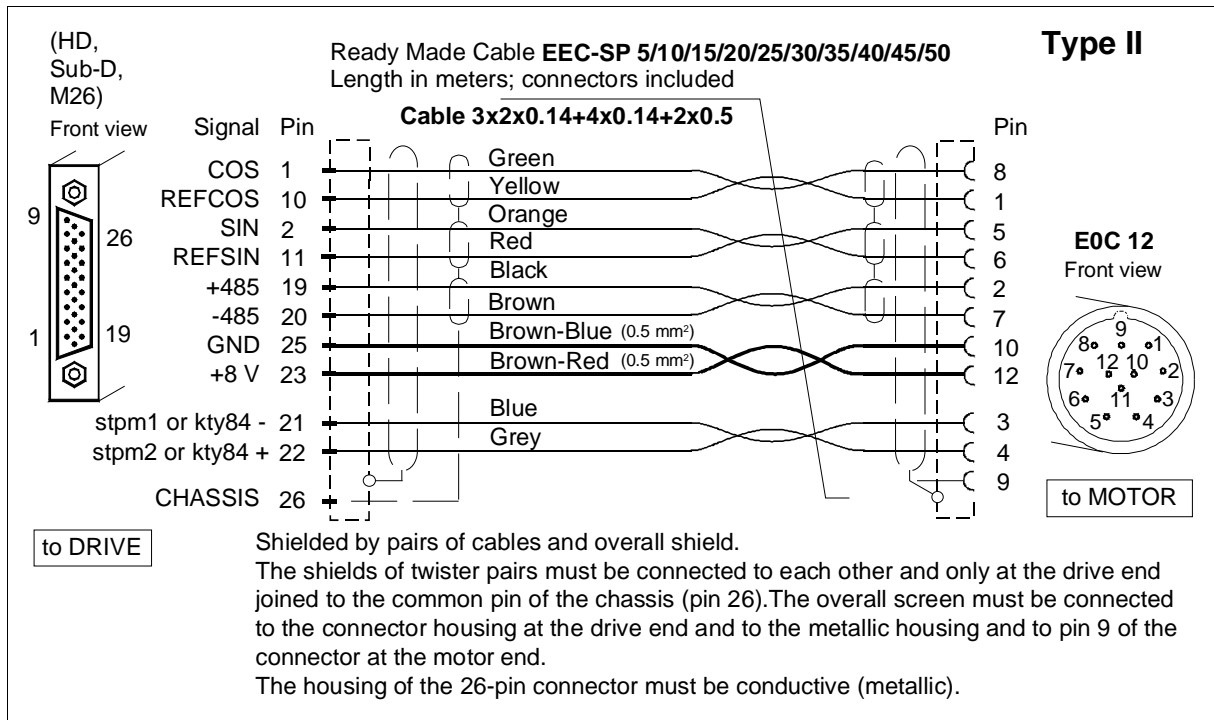
Sinusoidal encoder connecting cable, EEC-SP

The EEC-SP cable transfers the motor feedback signals from the sinusoidal encoder to the drive. It has overall shield and shielded twisted pairs. This cable improves the system immunity against disturbances and provides more flexibility than the previous EEC cable.



Note that type I and II of the EEC-SP extension cables are the same except the color of their wires. The user must check which one of them matches the one being installed.





Codes of the sales reference of Fagor cables

CABLE ENCODER - DRIVE	Example: IECD -	20	
CABLE OF INCREMENTAL ENCODER			
LENGTH (m)	5, 7, 10, 15, 20, 25, 30		

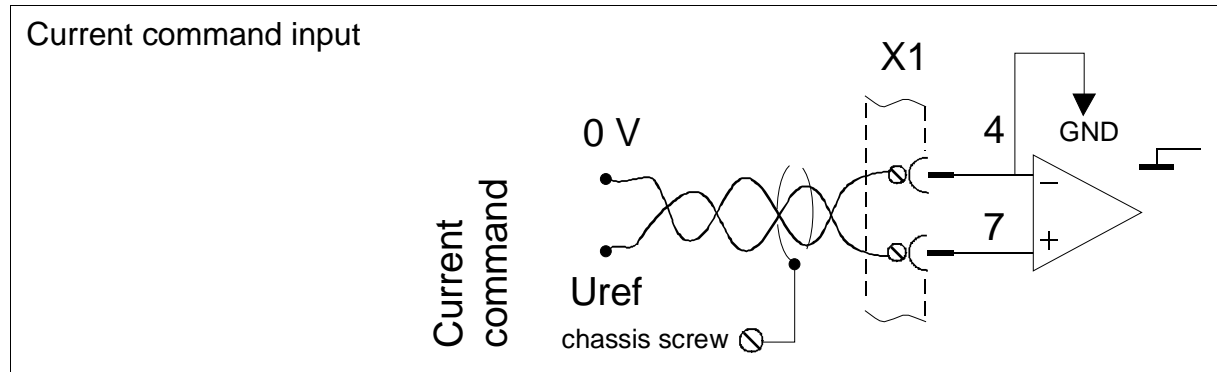
CABLE ENCODER - DRIVE	Example: EEC-	20	
CABLE for SinCos™ OR SinCoder™ encoder			
LENGTH (m)	1, 3, 5, 7, 10, 15, 20, 25, 30, 35, 40, 45, 50		

CABLE ENCODER - DRIVE	Example: EEC-SP-	20	
CABLE for SinCos™ OR SinCoder™ encoder			
LENGTH (m)	5, 10, 15, 20, 25, 30, 35, 40, 45, 50		

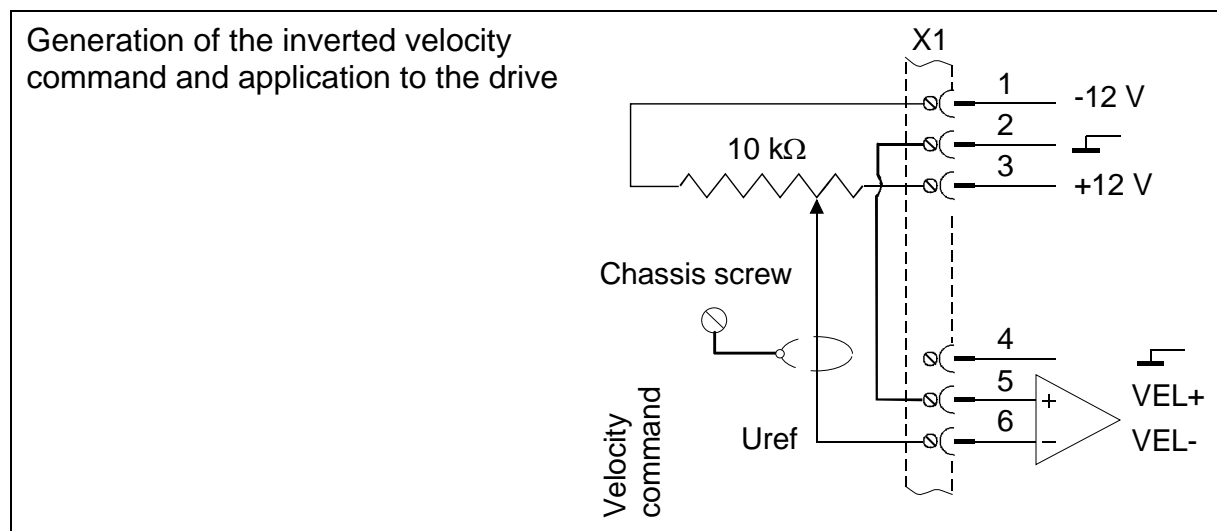
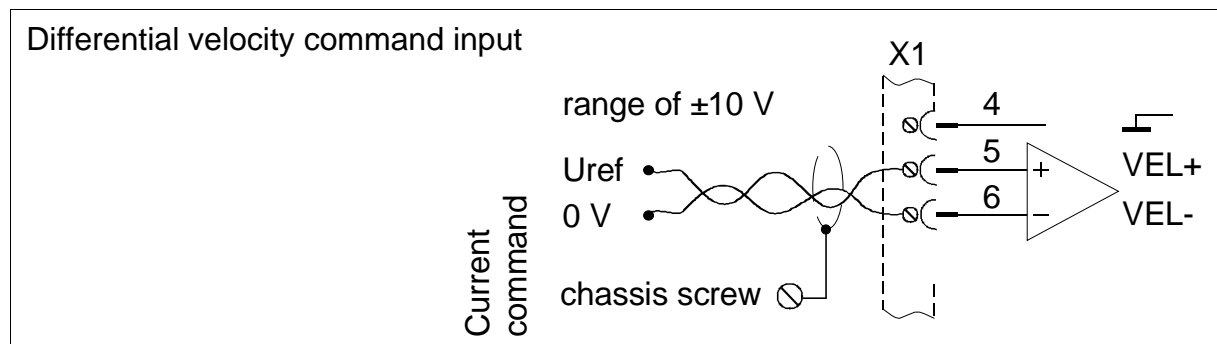
ENCODER CABLE - 8055/55i CNC	Example: SEC-HD-	20	
ENCODER SIMULATOR CABLE			
LENGTH (m)	5, 10, 15, 20, 25, 30, 35		

Analog command signal connection

The command governing the motor may be a velocity or current command. All the command signal lines must be shielded twisted pairs. The shield must be connected to the voltage reference at the module (pins 2, 4 and 10).



The input impedance of the velocity command is $5.6\text{ k}\Omega$ (a range $\pm 10\text{ V}$). The input impedance of the current command is $5.6\text{ k}\Omega$ (a range $\pm 10\text{ V}$).



MCP and PC connection. RS-232 serial line

Connecting a PC compatible computer with an MCP drive via RS-232 makes it possible to set and monitor system variables facilitating its adjustment. The motor table may be updated in the E²Prom through this line. The connection cable is:

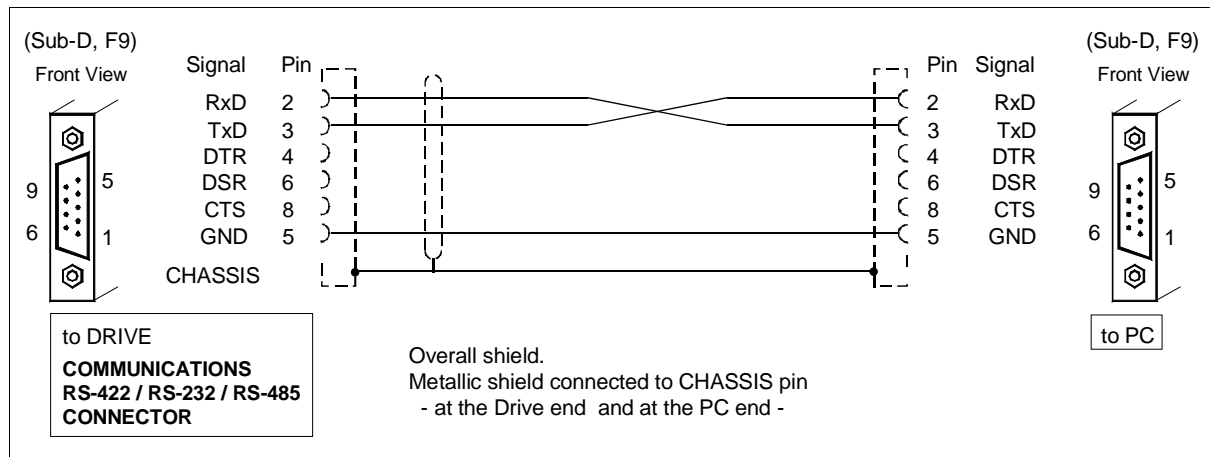


Diagram of the electrical cabinet

This is an orientative diagram for the installation of the electrical cabinet. This diagram may be modified according to the requirements of each application. It includes a simple circuit for the voltage supply of the brake of the servo motors.

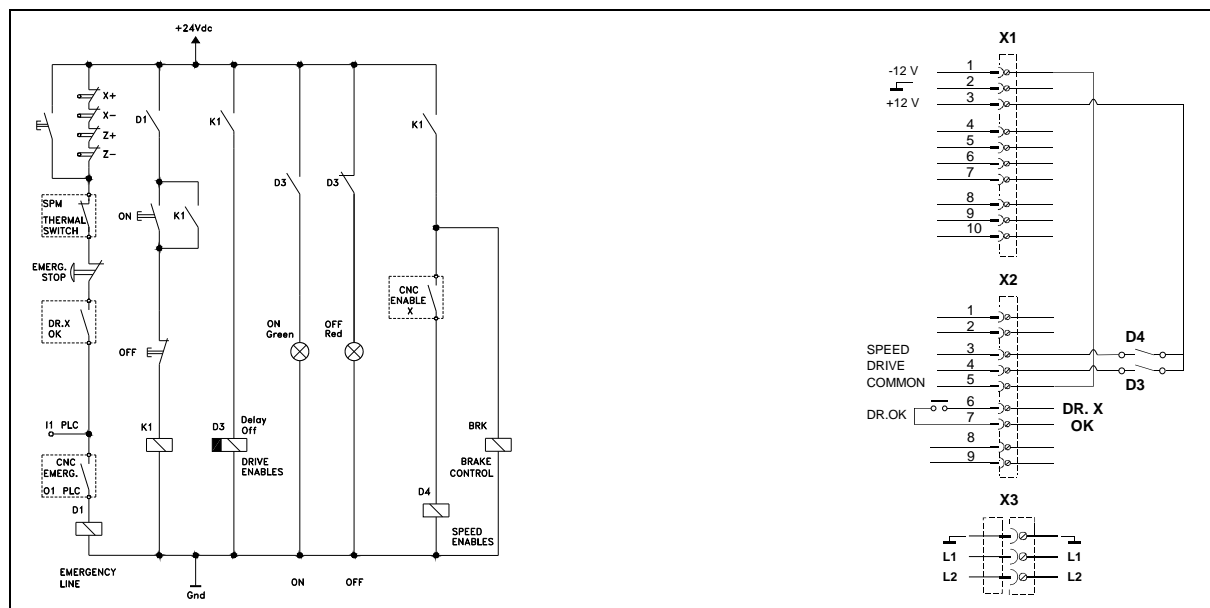
Warning. When installing an auto-transformer, the secondary must have a star connection and its middle point must be connected to GND.

Warning. The use of fuses is a must.

Mains connection and maneuver diagram

The delayed disconnection of D3 contacts is useful so:

- ❑ The Drive Enable stays active while the motor brakes at maximum torque.
- ❑ The brake holds the motor after it has stopped.



Initialization and adjustment

The initialization and adjustment procedure can only be carried out using the PC application software WinDDSetup version V06.03 and later. After connecting the serial line communication cable between the drive and the PC and starting up the motor-drive system, it will be necessary to keep the COMM SETTINGS push-button pressed for 5 seconds for automatically setting the default values of the serial line communication parameters which are:

Transmission speed of 9600 baud, no parity, 8 data bits, 1 stop bit, "ModBus RTU 232" communications protocol and node number 1.

All of the possibilities for displaying and modifying parameters, variables and commands can only be accessed from the WinDDSetup and their availability depends on a particular access level.

The possible access levels are: Fagor level, user level or basic level that restrict the access to all or some parameters depending on the level. By default, the access level is the basic one.

To change the access level, enter its corresponding code in the field that expands when activating the labels "SetUp > Acces level" from the main window of the WinDDSetup.

Then:

If the system consist of an MCP drive with a motor having an **encoder with an incremental I0**, the drive must be told which type motor it must govern by means of parameter **MP1**.

When connecting a motor that uses a SinCos™ or SinCoder™ encoder, this operation is not necessary because the encoder will "tell" the drive which type of motor it is mounted on.

Although it is less frequent, in the case of the sincoder, it is also possible that the sincoder does not inform the drive about the type of motor it is installed in; thus the MP1 parameter must be edited like with incremental encoder I0. To operate in this mode, the automatic initialization of the encoder must be disabled by setting parameter GP15=0.

Once the motor has been defined, it must be initialized with the GC10 variable in order to set the initial values for the drive that matches the selected motor.

Everything done so far is stored in RAM memory, but not permanently. So, all these modifications will be ignored if a reset is carried out because, when starting up again, the drive assumes the configurations stored in its E²Prom.

Therefore, to store all these modifications permanently, the information stored in RAM memory must be saved (transferred) into E²Prom memory using the GC1 command and then do a SoftReset (GV11).

To obtain information on the type of drive (only informative, cannot be manipulated) coherent with the selected motor, check GV9. If for any reason, the access level must be changed, type the new access code in the field that expands after selecting "SetUp > Acces level".

Then, execute the GC1 command. Finish the procedure with a reset.

On the other hand, when adjusting it, proceed as follows:

- ❑ Verify that desired velocity or current command is selected. To do this, make sure that all the parameters involved (such as SP45, WV4,...) are properly set.
- ❑ When using external analog command, verify that it is output to the proper pins.

When using analog command, set parameters SP20 and SP21 with the proper values in order to obtain the desired response to the velocity command entered.

- ❑ Use parameter CP20 to set the maximum peak current value of the drive to obtain the best dynamic response.
- ❑ Set the velocity PI gain using parameter SP1 (proportional gain K) and SP2 (integral K) until the desired system performance is obtained.
- ❑ Adjust the velocity offset using parameter SP30.
- ❑ Send a 0 V velocity command to the drive (jumping pins 4, 5 and 6 of connector X1).
- ❑ Measure the motor speed and adjust the offset using parameter SP30 until the motor stops. Be careful because this method only eliminates the offset of the drive. The CNC may have an offset of its own which must be adjusted at the CNC.

Software interface

The system is programmed in table mode (structured in a table format). In this programming mode, the PLC program, the positioning program and the motion control program are integrated in a single command line using a special syntax that makes programming easier. This syntax has been designed in order to cover all the applications foreseen to be carried out by this unit.

Types of positioning

The types of positioning that the MCP drive has been designed for are:

- ❑ Linear axes with motor feedback.
- ❑ Linear axes with direct feedback.
- ❑ Linear axes with motor feedback and direct feedback.
- ❑ Rotary axes with motor feedback.
- ❑ Rotary axes with direct feedback.
- ❑ Rotary axes with motor feedback and direct feedback.

Table editor syntax

The table offers the following fields:

- BLOCK Nr.
- POS_MODE
- POS_VAL
- VELPOS
- EVENT_TYPE
- FAST INPUT
- TIME
- PROGOUT
- LOOP
- NEXT
- INCR - CNT
- CNDTNL_JMP

Block_Nr

This field indicates the block number to be assigned to the current line.

In automatic mode, the START input starts the execution of the program at the block number defined by the binary coded formed by inputs S0 through S4.

Pos_mode

This field determines the positioning mode to be carried out in the current block. Possible modes:

MODES	FUNCTION
ABSOLUTE	Absolute positioning mode. The axis will move to the absolute position indicated in POS_VAL and at the feedrate given in VELPOS.
INCREMENTAL	Incremental positioning mode. The axis will move to the relative position indicated in POS_VAL and at the feedrate given in VELPOS.
+ INFINITE	Infinite movement in positive direction. The axis moves without a target at the feedrate given in VELPOS.
- INFINITE	Infinite movement in negative direction. The axis moves without a target at the feedrate given in VELPOS.
STOP	The motor shaft does not turn and it changes to the next block depending on the event selected.

Pos_val

This field determines the target position of the movement. This value may be either positive or negative. The base unit is a tenth of a micron (for linear movements) or a tenth-thousandth of a degree (for rotary movements).

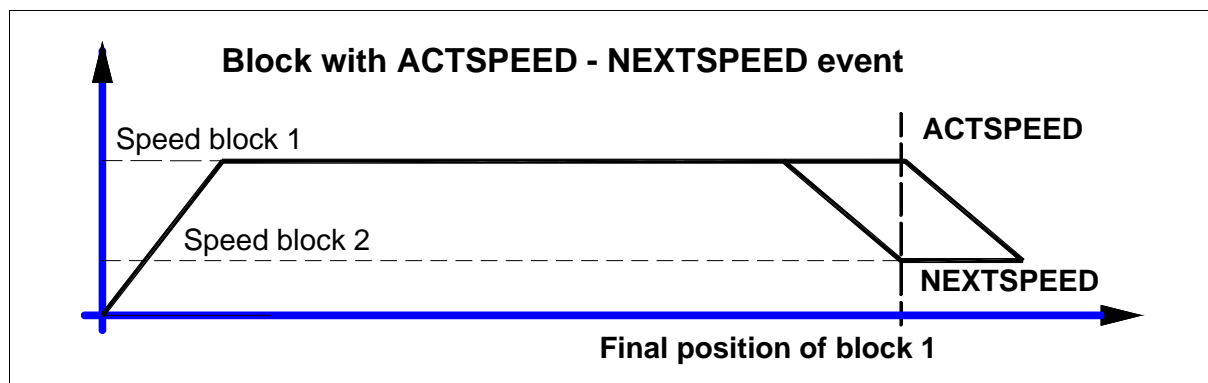
vel_pos

This field determines the feedrate for the movement. This value has no sign. The base units are mm/min (for linear movements) or degrees/min (for rotary movements).

even_type

This field determines the type of event that must take place so the commands and conditions indicated in the following fields are taken into account: TIME, PROGOUT, LOOP and NEXT. Possible events:

EVENTS	FUNCTION
INRPOS	The axis is in real position. This event is triggered when the position reached by the axis is inside the in-position zone (dead band) indicated by parameter PP57 < PositioningWindow > .
INTPOS	The axis is in theoretical position. The event is triggered when the position command generated by the command generator is in the theoretical position of the block.
INBAND	The event is triggered when the axis is inside the in-position zone indicated by parameter LP49 < InBand Position > . See the warning on the next page.
ACTSPEED	This event is triggered when in the acceleration process of the movement, it has reached the positioning feedrate indicated in VEL_POS of the current block. It has the same functionality as a "feedrate reached" function. See figure below.
NEXTSPEED	This event is triggered when in the block transition process it reaches the feedrate indicated in the next block; this transition is established in POS_VAL of the current block. Its purpose is to make a movement transition so the feedrate does not have to go through zero. See figure below.
NONE	No event expected.





Do not to mistake the INBAND event with the INRPOS event. The window specified in parameter PP57 is for positioning and affects all of them. The window indicated in parameter LP49 only affects the INBAND event.

inifast

This event takes place when activating the fast input EXTERNAL FAST IN. This event is an OR condition to go to the next block.

time

This field indicates the time that must elapse from the instant the EVEN_TYPE event has been triggered in the field to update the outputs as indicated in PROGOUT and go on to interpret the following fields LOOP and NEXT. The units are given in ms.

progout

This field determines the status to be taken by the 8 programmable outputs after the event indicated in EVEN_TYPE has taken place and the time indicated in TIME has elapsed. The structure of the format is a string of bits like this:

OUT8 OUT7 OUT6 OUT5 OUT4 OUT3 OUT2 OUT1

Example:

```
PROGOUT
10110011
```

showing the activated outputs (8, 6, 5, 2 and 1) and the deactivated ones (7, 4 and 3).

loop

This fields sets the number of times the movement indicated in the current block is repeated. Once the current block is repeated as many times as indicated by LOOP, it interprets the NEXT field.

next

This field determines the positioning block number that takes control when the execution of the current block is completed. Possible values:

- ❑ Any valid block number between 1 and 128.
- ❑ NEXT. It indicates the block to be executed next, in the next block (current block +1).
- ❑ END. It indicates that the positioning table ends after executing the current positioning block. To execute it again, press START again.

incr-cnt / cndtnl_jmp

When beginning to move after pressing START, the positioning motor stores in memory the value of register **RG1 < PiecesCount >** (number of pieces to make) Every time the positioning table contains an activated INCR-CNT, in adds one unit to the number of parts made. This value will be reflected in register **RG2 < ActualPiecesCount >** and when this value is equal to **RG1 < PiecesCount >**, the next block will not be NEXT, but " CNDTNL_JMP".

Structure of the positioning block

Block addressing base

The base address for motion blocks is 6000h. Each motion block has 16 words. It reserves a whole block for version data; therefore, block number 1 will be located in the motion block address 6010h.

□ Full block addressing

ModBus address

In decimal: $24576 + (16 \cdot \text{block number})$

In hexadecimal: $6010h + (10h \cdot \text{block number } h)$

Number of registers

There are 16 registers, but **only 12** of them are useful.

□ Addressing part of the block

ModBus address

In decimal: $24576 + (16 \cdot \text{block number}) + \text{Block word number}$

In hexadecimal: $6010h + (10h \cdot \text{block number } h) + \text{block word number}$

Number of registers

The number of registers the one required by the specific field. For example: time of the event of block 4. **Address:** $6010h + (10h \cdot 4) + 7 = 8037h$. **Number of registers:** 2

Field description	Reserved	LOOP	NEXT	PROGOUT	EVENT		
					TYPE		TIME
Value	0000h	0000h to FFFFh	0001h to 0080h " OR " Parts counter SC00h END=xxFEh ^{1/}	00000000h to 000000FFh	InRpos (real) InTpos (theoretical) InBand ActSpeedReached NextSpeedReached FastInput ^{2/}	0001h 0002h 0003h 0004h 0005h "OR" 0100h	0000h to FFFFh
WORD Nr	15-12	11	10	9-8	7		6

Field description	VELPOS	POSDEST		
		VALUE	MODE	
Value	00000000h to FFFFFFFFh	00000000h to FFFFFFFFh	Absolute Incremental + Infinite - Infinite Stop	0000 0001 h 0000 0002 h 0000 0003 h 0000 0004 h 0000 0005 h
WORD Nr	5-4	3-2		1- 0

1/ Word Nr 10, <next block> has two bytes with different functions.

Low Byte: indicates the number of the next block to execute (valid values between 1 and 127 and also 254).

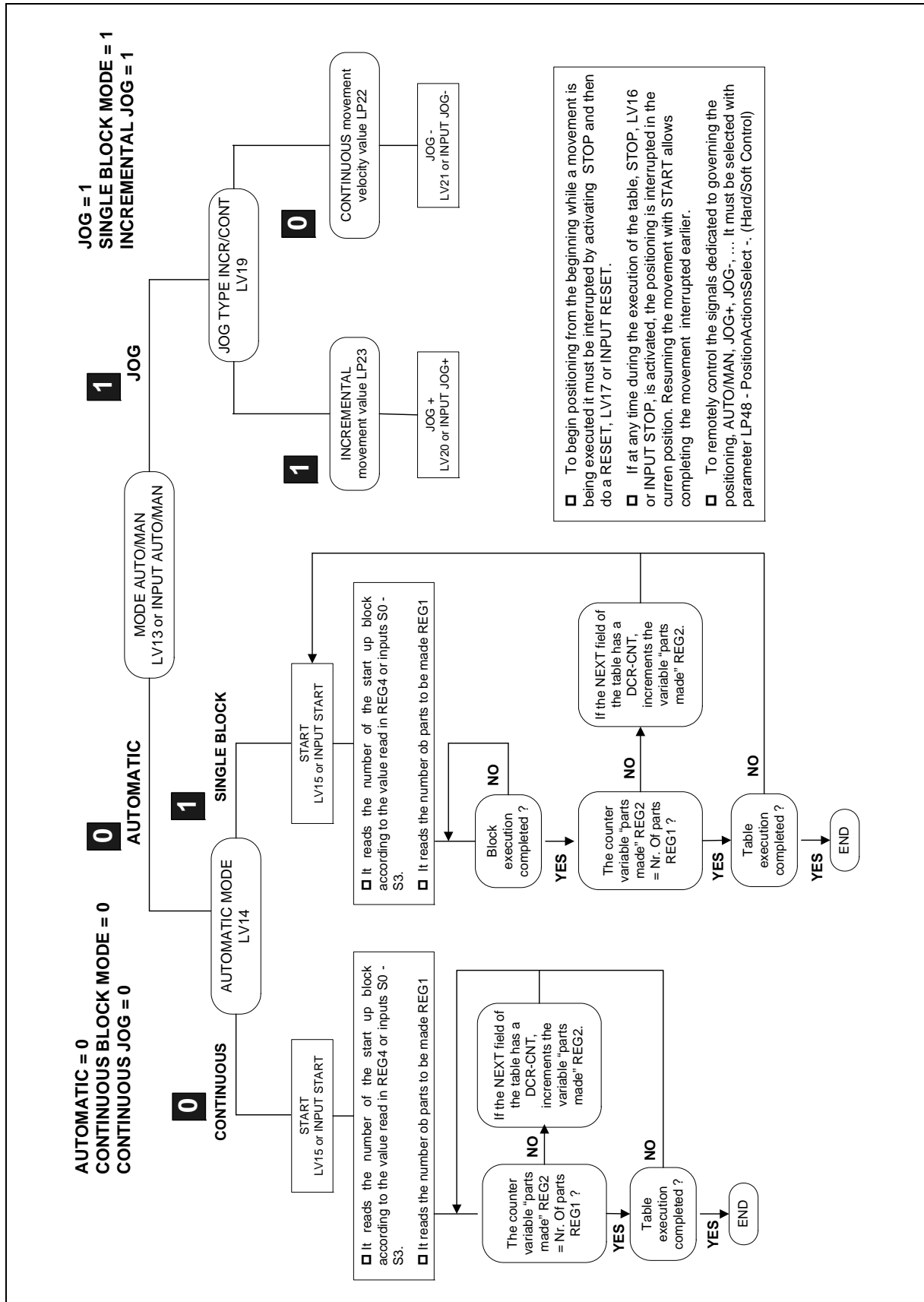
High Byte: SC (Conditional **jump**). To increment the "parts made" counter at the block (RG2), this byte must take a value other than zero. When the parts counter matches the desired number of parts (RG1), the next block to be executed will be the one indicated in this byte.

END (xxFEh): Regardless of the value of the high byte (xxh), entering FEh in the low byte will mean the last block of the program.

2/ If you wish the "next block" condition to be "theoretical position reached" or the activation of the fast input, the value to enter will be 0102h.

Table executing mode

A table is executed according to this diagram:



Process description

The positioning drive MCP may be governed remotely through ModBus using the drive's serial line. Set parameter **LP48 < PositionActionsSelect >**.

The “hardware/software” may be selected either as a whole or individually. See parameter **LP48 < PositionActionsSelect >**.

Hardware (0), the status of the “hardware inputs” dedicated to the kernel is reflected in its corresponding variable.

Software (1), the status of the “hardware inputs” will have no effect on its variable and the functionality control of said variable will be fully via software.

The kernel commands affected by parameter **LP48** are:

- ❑ RG4 - PositionBlockIni -
- ❑ LV13 - KernelOperationMode -
- ❑ LV15 - KernelStartSignal -
- ❑ LV16 - KernelStopSignal -
- ❑ LV17 - KernelResetSignal -
- ❑ LV20 - JogPositiveSignal -
- ❑ LV21 - JogNegativeSignal -
- ❑ PC148 - DriveControlledHoming -
- ❑ PC150 - ChangePosFB12 -

The process varies depending on the operating mode in variable **LV13 < KernelOperationMode >** (automatic or jog).

The “hardware” travel limits are always active and the “software” limits set by parameters: **PP49 < PositivePositionLimit >** and **PP50 < NegativePositionLimit >** will be active if they are activated by parameter: **PP55 < PositionPolarity Parameters >**.

JOG mode

This operating mode is selected by setting LV13=1 <KernelOperationMode>.

In Jog mode, a movement may be made depending on the submode:

Continuous LV19 = 0 < KernelManMode >

Incremental LV19 = 1 < KernelManMode >

The continuous submode sets a continuous movement at a feedrate preset by parameter **LP22 < JogVelocity >** while keeping JOG + or JOG pressed.

The incremental submode, sets an incremental movement with a position increment per each press of the JOG + or JOG- key given by parameter **LP23 < JogIncrementalPosition >**.

The variables associated with the inputs JOG+ and JOG- in jog are LV20 < JogPositiveSignal > and LV21 < JogNegativeSignal > respectively.

Automatic operating mode

This operating mode is selected by setting LV13 = 0 <Kernel OperationMode>

In automatic mode it is possible to determine how to go through the positioning table edited:

□ Single block mode. LV14=1 <KernelAutoMode>

After actuating upon the START input, the first block is reflected in PLC register **RG4 <PositionBlockIni>** .

This value is defined by “hardware” inputs S0 through S4 so long as parameter **LP48 <PositionActions Select>** is set to “0”.

At the same time, it loads the value of **RG1 <PiecesCount >** (counter of parts to make).

It then starts executing the indicated block and the positioning ends when the block execution is completed.

To resume the positioning in the block given by the field NEXT of the positioning table, activate the START input again and so on block by block to the end of the table (when the NEXT field contains an END or when the parts-made counter given by **RG2** is equal to the number of parts-to-be-made given by **RG1**).

□ Continuous mode. LV14=0 <KernelAutoMode>

Process identical to the previous one except that it does not require activating the START input to go from one block to the next because it goes through the whole program.

Activating the **LV16 <KernelStopSignal>** while executing a particular positioning table interrupts the positioning. Activating the START input resumes the movement just from precisely the interruption point.

If at any point in the execution of the program, you wish to restart the movement from the beginning of the table, the execution will be interrupted by pressing STOP and then input RESET, **LV17 <Kernel ResetSignal>** or Input RESET.

Variables for positioning status

All the variables of the positioning drive are available to be displayed or used by other applications through ModBus. This group of variables give an idea of the status of the positioning in progress. The available variables are:

RG3	RunningBlock	It reflects the number of the block being executed.
LV35	BlockTravelDistance	It reflects the target position of the current block.
LV158	TargetPosition	Final target position on the absolute axis of the positioning drive.
LV36	BlockCoveredDistance	Distance interval traveled so far in the current block.
PV51	PositionFeedback1	Absolute distance traveled so far (motor feedback).
PV53	PositionFeedback2	Absolute distance traveled so far (direct feedback).
LV159	PositioningVelocity	Positioning feedrate in the current block.
PV189	FollowingError	Following error of the position loop.
RG2	ActualPiecesCount	Number of parts made so far.

Configuration of the positioning drive

There is a group of parameters to set the desired configuration of the positioning drive. We recommend to enter the values of these parameters in the order (sequence) described next. They are grouped like this:

General group

Set of parameters for the overall configuration of the positioning drive. They are:

AP1 PrimaryOperationMode

Operating mode of the drive.

Its value sets one of the following configurations as a drive for:

- VELOCITY <0-1-2>**. Equivalent to the operation of the MCS drive.
- POSITION WITH MOTOR FEEDBACK <3>**. The position feedback device of the application is the feedback integrated into the motor itself (incremental TTL encoder of 2500 ppt or SinCos™ or SinCoder™ encoder).
- POSITION WITH DIRECT FEEDBACK <4>**. The position feedback device of the application is and external feedback device (incremental TTL encoder of 2500 ppt or SinCos™ or SinCoder™ encoder).

❑ **POSITION WITH MOTOR OR DIRECT FEEDBACK <5>**. The positioning measuring element of the application may be set from either one of the two feedbacks. The feedback may be changed in ONLINE mode by software or hardware. The movements in this mode will only be incremental. The feedback must always be changed with the motor stopped. If the change command is given while the motor is still running, it will not take place until the movement is stopped.

❑ **Feedback change (by software)**

"PC150 (ChangePosFB12)" command, with "IP14 (DigitalInputFunctionSelector)" other than zero and "LP48 (PositionActions Select)" as control of the feedback change either by software (bit 8) or as a whole.

❑ **Feedback change (by hardware)**

It may be selected through the digital input of X1 with "IP14 (DigitalInputFunctionSelector)" equal to zero and as control of the feedback change either by software (bit 8) or as a whole.

PP76 PositionDataScalingType

It determines whether the configuration of the mechanical system is for a linear or rotary axis. For the rotary axis, it also indicates whether the configuration is either in module or absolute format.

PP57 PositionWindow

Positioning window. It sets the in-position zone considered valid to consider it that it is in position.

PP159 MonitoringWindow

Following error window. Determines the margin of following error allowed before issuing a following error warning.

LP49 InBandPosition

Window that determines the position range where the INBAND event may be triggered in the positioning table.

PP55 PositionPolarityParameters

The bits of this parameter set certain aspects of the system startup; they are:

- ❑ Limits on/off "via software" (PP49 and PP50).
- ❑ Interpretation of the inverted position command. It affects the loop.

PP49 PositivePositionLimit

Value of the maximum absolute "software" positive position limit.

PP50 NegativePositionLimit

Value of the maximum absolute "software" negative position limit.

Axis configuration group

PP76 PositionDataScalingType

Parameter common to the linear and rotary axes. See GENERAL GROUP described earlier for further detail.

PP103 ModuleValue

Value of the module of a rotary axis.

LP143 ModuleCommandMode

Position search mode for rotary axes. It may indicate that the position search is carried out:

- clockwise.
- counterclockwise.
- via shortest path.

Motor feedback

NP121 InputRevolutions

NP122 OutputRevolutions

These parameters set the mechanical ratio between the motor shaft and the final axis of the movement.

NP123 FeedConstant

Linear feed per turn of the leadscrew, i.e. leadscrew pitch.

Direct feedback

Set of parameters for configuring various aspects related to direct feedback. They are:

NP131 InputRevolutions2

NP132 OutputRevolutions2

These parameters determine the mechanical ratio between the measurement point and the input to the drive.

NP133 FeedConstant2

Pitch of the linear encoder. For a linear encoder, the pitch value must be given in tenths of a micron.

NP117 ResolutionOfFeedback2

Direct feedback resolution when using a rotary encoder. Its value is given in **pulses per turn** (ppt).

NP118 ResolutionOfLinearFeedback

Direct feedback resolution when using a linear encoder. Its value will be given in μm (tenths of a micron).

PP115 PositionFeedback2Type

Installation configuration. This parameter may be used to select either a linear encoder or a rotary encoder as direct feedback. Also, one of its bits indicates to the drive whether the position feedback generated by the direct feedback must be inverted or not in the position loop.

Position loop adjusting group

PP104 PositionKvGain

Proportional gain of the position loop.

PP105 PositionKvGain2

Proportional gain of the position loop with direct feedback.

PP216 VelocityFeedForwardPercentage

position loop feed-forward adjusting group.

PP218 VelocityFeedForwardPercentage2

Feedforward of the position loop with direct feedback.

LV160 PositioningAcceleration

Positioning acceleration. It sets the amount of acceleration applied to the positioning movements.

LV161 PositioningAcceleration2

Positioning acceleration with direct feedback.

Home search group

Set of parameters to configure the home search. They are:

PP1 HomingVelocitySlow

Slow home searching feedrate. It sets the home searching feedrate in its final approach (after having pressed the home search).

PP41 HomingVelocityFast

Fast home searching feedrate. It sets the home searching feedrate for its approach (until the home switch is pressed).

PP42 HomingAcceleration

Value of the acceleration during home search.

PP52 ReferenceDistance1

Reference distance. Position value given to the position loop when the reference mark (I0) is detected.

PP54 ReferenceDistance2

Reference distance with direct feedback. Value assigned to the position counter when the home search with direct feedback detects the reference mark (I0).

PP147 HomingParameter

Home search configuration. It sets certain aspects of the home search.

- ❑ Whether there is a home switch or not.
- ❑ Whether it is carried out with motor feedback or with direct feedback.
- ❑ Whether the home switch signal is considered inverted or not.
- ❑ Whether the home search is always done clockwise or counterclockwise.
- ❑ Whether the motor feedback reference mark is ignored or not.

Commands

PC148 DriveControlledHoming

Command to initiate the home search. Executing this command initiates the home search. It must be borne in mind that the software control of the Kernel (parameter **LP48** activated), the input dedicated to this command has no effect.

PC150 ChangePosFB12

Feedback changing command. When set to "3", it uses direct feedback and when set to "0", it uses motor feedback.

- ❑ The selected control of the digital inputs is fully by hardware (see parameter LP48), but IP14 is other than zero (0 function).
- ❑ The selected control of the digital inputs is fully by software (see parameter LP48).
- ❑ The selected control of the digital inputs is individual (see parameter LP48), but bit 8 is set to "1" (control by software).

PARAMETERS, VARIABLES & COMMANDS

Notation used

<Group> <Type> <Index> where:

Group: Identifying character of the logic group to which the parameter or variable belongs.

There are the following groups of parameters:

GROUPS OF PARAMETERS, VARIABLES & COMMANDS			
Nr	FUNCTION	GROUP	LETTER
1	Operating mode	Application	A
2	Control signals	Terminal box	B
3	Current control loop	Current.	C
4	Error diagnosis	Diagnosis	D
5	Encoder simulator	Encoder	E
6	General of the system	General	G
7	System hardware	Hardware	H
8	Analog and digital inputs	Inputs	I
9	Temperatures and voltages	Monitoring	K
10	Motion Control and PLC	MC and PLC	L
11	Motor properties	Motor	M
12	Linear configuration	Linear axis	N
13	Analog and digital outputs	Outputs	O
14	Position loop	Position	P
15	System communication	RS232/422/485 Modbus	Q
16	Rotor sensor properties	Rotor	R
17	Velocity control loop	Speed:	S
18	Torque and power parameters	Torque	T

Type. Character identifying the type of data which the information corresponds to. May be:

- Parameter (P) defining the system operation.
- Variable (V) that can be read and modified dynamically.
- Command (C) that carries out a specific action.

Index. Character identifying the parameter or the variable within the group to which it belongs.

Definition examples:

SP10: **S** group, (P) Parameter, (Nr) 10.

CV11: **C** group, (V) Variable, (Nr) 11.

G group, (C) Command, (Nr) 1.

Access level.

The access level is defined by the number following the ID:

Thus:

- Fagor level
- User level
- Basic level

Examples of access levels

SP10 **basic**: S group, Parameter P, Nr 10, Access level (**basic**)

CV11 **Fagor**, RO: C Group, V variable, Nr 11, Access level (**Fagor**), read-only variable (RO).

Modifiable variable.

Any modifiable variable, in other words, that can be read and written, will carry the (RW) label to identify it as such next to its access level. The (RO) label means that the variable is Read Only.

Note that all the parameters have the (RW), i.e. they can be read and written.

Example of a modifiable variable

DV32 Fagor, **RW**: D Group, V Variable, Nr 32, (Fagor) Access level, (**RW**) modifiable.

A group. Application

AP1	FAGOR, RW	PrimaryOperationMode
------------	------------------	-----------------------------

Function. It sets the operating mode according to the configuration of the system.

Value	Function
2	Velocity command (without position loop)
3	Position command with motor feedback
4	Position command with direct feedback
5	Position command with motor feedback or direct feedback

Warning. If AP1=5, only incremental movements are possible and no home search is possible. Besides, the feedback change will only be effective while the motor is stopped.

Default value. AP1=3, position command with motor feedback..

B group. Non-programmable inputs - outputs

BV14	FAGOR, RO	NotProgrammableIOs
-------------	------------------	---------------------------

Function. Indicates the logic values of the electrical control signals of the drive. 24V at the electrical input mean a logic 1 at the bits of this variable.

BIT Nr.	Function
15, ..., 4	Reserved
3	Programmable input. Pins 8 -9 of terminal strip X2 Default value (IP14=4), error RESET.
2	Drive_OK output. Pins 6 -7 of terminal strip X2.
1	Speed_Enable input. Pin 3 of terminal strip X2.
0	Drive_Enable input. Pin 4 of terminal strip X2.

C group. Current

CP1	FAGOR	CurrentProportionalGain
------------	--------------	--------------------------------

Funtion. Value of the proportional action of the current PI,

Valid values. 0, ..., 999.

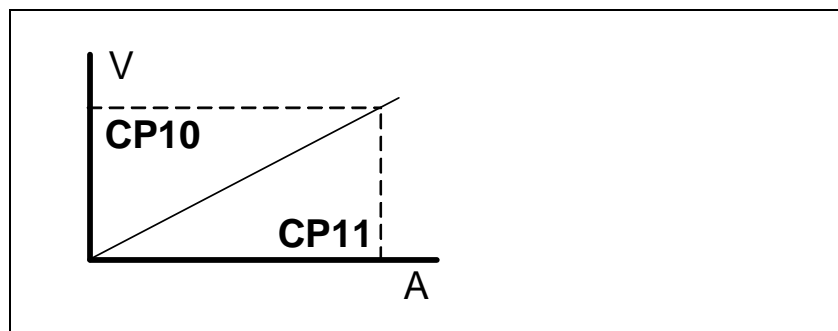
Default value. Depends on the motor-drive combination.

CP2	FAGOR	CurrentIntegralTime
------------	--------------	----------------------------

Function. Value of the integral action of the current PI.
Valid values. 0, ..., 999.
Default value. Depends on the motor-drive combination..

CP10	USER	VoltageAmpVolt
-------------	-------------	-----------------------

Function. Parameters CP10 and CP11 define the relationship between the voltage of the analog input IV2 and the current that this input generates in IV3.
Valid values. 1.000, ..., 9.999 V.
Default value. 9.500V.



CP11	USER	AmpAmpVolt
-------------	-------------	-------------------

Function. See parameter CP10.
Valid values. 1.00, ..., 50.00 A. Depends on the connected drive.
Default value. MP3 in A. Rated motor current.

CP20	BASIC	CurrentLimit
-------------	--------------	---------------------

Function. Limit of the current command that reaches the system's current loop.
Valid values. 0.00, ..., 50.00 Arms. CP20 must never exceed the smallest value given by the peak current of the motor (5 x MP3) and of the drive.
Default value. CP20 takes the lowest value of the ones given by the motor and drive peak currents.

CP30	FAGOR	CurrentCommandFilter1Type
-------------	--------------	----------------------------------

Function. Enables / disables the current filter.
Valid values. 0/1. Enables / Disables the filter.
Default value. 0.

CP31 FAGOR	CurrentCommandFilter1Frequency
-------------------	---------------------------------------

Function. Sets the natural frequency in Hz of a notch filter that acts upon the current command.

Valid values. 0, ..., 4000.

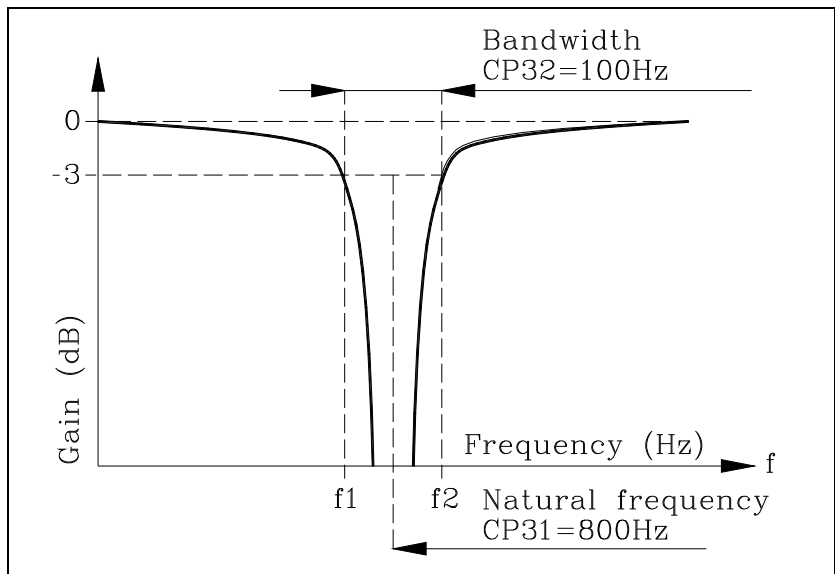
Default value. 0.

CP32 FAGOR	CurrentCommandFilter1Damping
-------------------	-------------------------------------

Function. Sets the bandwidth in Hz of a notch filter that acts upon the current command.

Valid values. 0, ..., 1000.

Default value. 0.



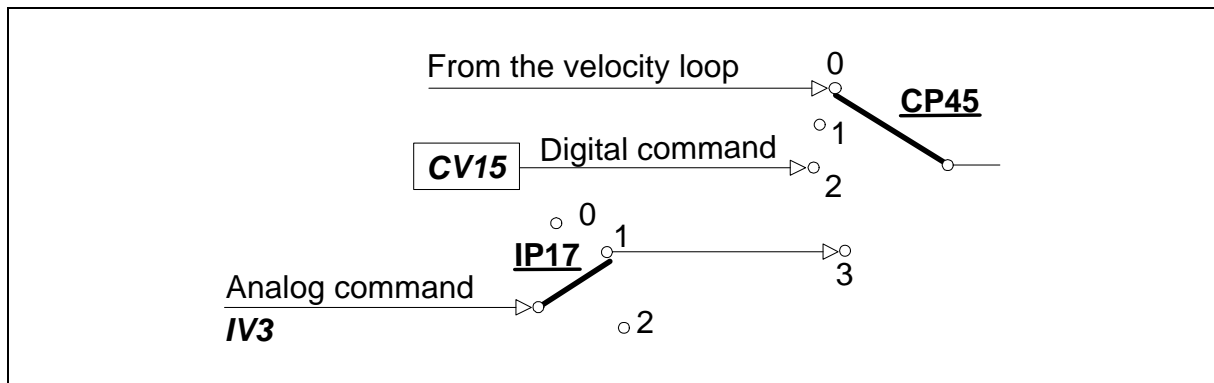
CP45 USER	CurrentCommandSelector
------------------	-------------------------------

Function. This parameter is used to determine the command source of the current loop.

Valid values. 0, 1, 2 and 3.

Value	Function
0	Normal operation. The current command comes from the velocity loop.
1	Reserved.
2	Digital. value of GV15 that can be modified through the serial line.
3	External analog. It applies the value of the external auxiliary input (pins 4 and 7 of connector X1) after being treated, IV3, if IP17 has the right value (IP17=1).

Default value. 0.



CV1	USER, RO	Current1Feedback
------------	-----------------	-------------------------

Function. Display the value of the feedback of the current going through phase V.

Valid values. - 50, ..., 50 A (instant values).

CV2	USER, RO	Current2Feedback
------------	-----------------	-------------------------

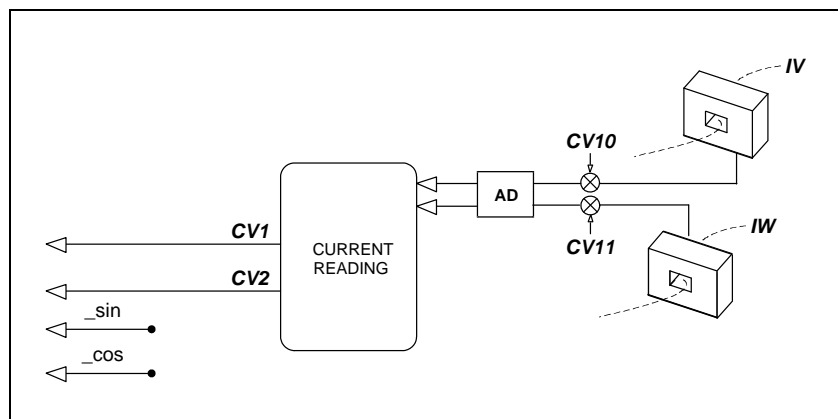
Function. Display the value of the feedback of the current going through phase W.

Valid values. - 50, ..., 50 A (instant values).

CV3	USER, RO	CurrentFeedback
------------	-----------------	------------------------

Function. Display the rms current circulating through the motor.

Valid values. 0, ..., 50 Arms (rms values).



CV10	FAGOR, RO	Current1Offset
-------------	------------------	-----------------------

Function. Value of the automatic compensation of the current feedback offset of phase V.

Valid values. - 2000, ..., + 2000 mA (depends on the connected drive).

CV11	FAGOR, RO	Current2Feedback
-------------	------------------	-------------------------

Function. Value of the automatic compensation of the current feedback offset of phase W.

Valid values. - 2000, ..., + 2000 mA (depends on the connected drive).

CV15	USER, RW	DigitalCurrentCommand
-------------	-----------------	------------------------------

Function. This variable registers the value of the digital current command.

Valid values. - 50.00, ..., 50.00 Arms.

Default value. 0.00 Arms.

D group. Diagnosis

DV17	USER, RO	HistoricOfErrors
-------------	-----------------	-------------------------

Function. It is a 5-word register that stores the numbers of the last 5 errors originated at the drive.

Valid values. All the numbers of the possible errors of the software version loaded. Code 0 means no error.

Default value. 0 (no error).

DV31	FAGOR, RO	DriveStatusWord
-------------	------------------	------------------------

Function. It contains a numerical data coded into 16 binary bits and represents the system status as shown by the attached table. It lists the bits (from the most to the least significant).

BIT Nr.	Function
15, 14	Power & Torque Status (0,0) DoingInternalTest (DRVSTS_INITIALIZATING. (0,1) ReadyForPower (DRVSTS_LBUS). (1,0) PowerOn (DRSTS_POWER_ON). (1,1) TorqueOn (DRSTS_TORQUE_ON).
13	Error bit.
12	Warning
11	OperationStatusChangeBit.
10, ..., 7	Reserved
6	ReferenceMarkerPulseRegistered
5	ChangeCommandsBit
4, ..., 1	Reserved
0	DriveStatusWordToggleBit

DV32 FAGOR, RW MasterControlWord

Function. It contains a numerical data coded into 16 binary bits and represents the control signals that act upon the drive through the serial line.

BIT Nr.	Function
15	Speed Enable
14	Drive Enable
13, ..., 7	Reserved
6	Homing Enable
5, ..., 1	Reserved
0	MasterControlWordToggleBit

DV50 FAGOR, RO ErrorBitArea

Function. It shows (bit by bit) the various possible errors of the drive.

Error name	Code on display	Associated bit
INTERNAL_FAULT	E.001	Bit 0
STOP_TIME	E.004	Bit 1
TEMP. DRIVE	E.106	Bit 2
TEMP. MOTOR	E.108	Bit 3
OVER_SPEED	E.200	Bit 4
I2T_MOTOR	E.201	Bit 5
I2T_DRIVE	E.202	Bit 6
OVER_CURRENT	E.214	Bit 7
OVER_VOLTAGE	E.304	Bit 8
BUS_MIN	E.307	Bit 9
PHASE_MISSING	E.003	Bit 10
I2T_BALLAST	E.314	Bit 11
NO_ENCODER	E.801	Bit 12
ENCODER_FAULT	E.802	Bit 13
RESERVED	-----	Bit 14
RESERVED	-----	Bit 15
ENCODER_VOID	E.803	Bit 16
SINCODER_SIGNALS	E.605	Bit 17
MP1_INCORRECT	E.510	Bit 18
RESERVED	-----	Bit 19
RESERVED	-----	Bit 20
RESERVED	-----	Bit 21
POS_FOLLOWING	E.156	Bit 22
NO_MOTOR_TABLE	E.506	Bit 23
INCOMPATIBLE_PARAM	E.502	Bit 24

DV51	FAGOR, RO	WarningBitArea
-------------	------------------	-----------------------

Function. Variable that shows (bit by bit) the various possible warnings of the drive.

Error name	Code on display	Associated bit
I2T_MOTOR	E.201	Bit 0
I2T_DRIVE	E.202	Bit 1
I2T_BALLAST	E.314	Bit 2
NO_BALLAST	E.003	Bit 3
ABSMOV_WITHOUT_HOMING	E.911	Bit 4
POSITIVE_POS_LIMIT	E.917	Bit 5
NEGATIVE_POS_LIMIT	E.917	Bit 6
POS_BLOCK_INI	E.157	Bit 7

DC1	USER	ResetClassDiagnostics
------------	-------------	------------------------------

Function. **Reset of the unit's errors.** When an error occurs, this command may be used to reset it and restart the unit by first updating the error bit of DV31 (DriveStatusWord) and then setting the drive in the ReadyForPower state. Note its difference with the unit's reset because the action carried out by this command **keeps the RAM memory intact** and therefore the parameter settings of the unit.

DC2	USER	ResetHistoricOfErrors
------------	-------------	------------------------------

Function. Reset of the DV17 (HistoricOfErrors) (array). This command sets it to 0.

E group. Encoder simulator

EP1	BASIC	EncoderSimulatorPulsesPerTurn
------------	--------------	--------------------------------------

Function. Number of pulses generated by the encoder simulator per rotor revolution. If the encoder is ref. I0 (2500 ppt), the parameter value of the encoder simulator output is set in 5 ppt increments and in 2 ppt increments if it is ref. E1, E3 or A0. Note that the unit can limit the bandwidth of the simulator output. Hence, if the encoder is:

- I0 (2500 ppt), it is not limited.
- SinCos and the it is a 3000 motor or less, it is not limited.
- SinCos and the it is a motor of more than 3000 motor, it is limited to 2048 output pulses.

Valid values. 0, ..., 4096.

Default value. Number of pulses of the selected feedback device.

EP3	BASIC	EncoderSimulatorDirection
------------	--------------	----------------------------------

Function. Selection of the turning direction of the simulated encoder.
Valid values. **0/1** Clockwise (by default) / Counterclockwise.

EP4	BASIC	EncoderSimulatorHighFreqEnable
------------	--------------	---------------------------------------

Function. Bandwidth limitation of the pulse simulator output. It only has an effect with SinCosTM type motor feedback. See parameter EP1.
Valid values. **0/1** Activate / Deactivate.
Default value. **0** Limitation activated. The high frequency of the encoder simulator output is not enabled..

G group. General

GP3	BASIC	StoppingTimeout
------------	--------------	------------------------

Function. After deactivating the Speed_Enable and after the GP3 time has elapsed, if the motor has not stopped, it cancels the torque automatically and issues error E.004. If the motor stops within the GP3 time, it also cancels the torque but does not issue an error. To make this time infinite (never generating error E.004), set this parameter to "0".
Valid values. 1, ..., 9999 ms, 0 (infinite).
Default value. 500 ms.

GP5	BASIC	ParameterVersion
------------	--------------	-------------------------

Function. This parameter represents the version of the parameter table loaded at the drive. E.g. for software V01.08, the value of GP5=108.

GP9	BASIC	DriveOffDelayTime
------------	--------------	--------------------------

Function. After the motor has stopped because the Speed Enable function has been disabled, the cancellation of the the Drive Enable function (that implies PWM-OFF) is delayed by a time period indicated by GP9. It is useful on axes not compensated with a holding brake. To make this time period infinite, set it to 0 and to remove it, set it to 1.
Valid values. 1, ..., 9999 ms, 0 (infinite).
Default value. 50 ms.

GP11 USER	IOFunctionsTime
------------------	------------------------

Function. Time used in functions OutFunc1 and OutFunc2.

Valid values. 0, ..., 9999 ms.

Default value. 2000 ms.

GP15 FAGOR	AutomaticInitialization
-------------------	--------------------------------

Function. When having a SinCos™ or SinCoder™ encoder, this parameter enables or disables the reading of MP1 directly from the sensor and consequently loading certain drive parameter automatically. See section **Initialization and adjustment** in this manual.

If GP15=0, it does not check the format of MP1.

Valid values. 0/1 Disables / Enables (by default).

GP16 BASIC	MonoPhaseSelector
-------------------	--------------------------

Function. Drives MCP-5L and MCP-10L (220 V) can work with single-phase power voltage without triggering the <phase missing> warning. This parameter has no effect on the rest of the units.

Valid values. 0/1 Disabled / Enabled.

Default value. 0 Disabled.

GV2 BASIC, RO	ManufacturerVersion
----------------------	----------------------------

Function. It registers the software version in use.

GV5 BASIC, RO	CodeChecksum
----------------------	---------------------

Function. It registers the checksum value of the software version loaded at the drive.

Valid values. - 9999, ..., 9999 (although the range goes up to 65535 because it is a 16-bit variable). The programming module can only display the 4 least significant digits.

Ej: If GV5 = 47234, the display of the programming module shows 7234.

GV7 BASIC, RW	Password
----------------------	-----------------

Function. Variable where the password is entered to change the access level. The system will change the access level corresponding to the password entered.

Valid values. 0, ..., 9999.

GV9	BASIC, RO	DriveType
Function.	It informs about the drive's sales reference. See section initialization and adjustment in this manual.	
GV11	BASIC, RW	SoftReset
Function.	It resets the unit by software.	
Valid values.	0 and 1 (with 1, it resets the unit).	
GV16	USER, RO	MotorTableVersion
Function.	Version of the motor table.	
GV75	FAGOR, RO	ErrorList
Function.	List of the error codes active in the unit.	
Valid values.	0, ..., 999.	
GC1	BÁSICO	BackupWorkingMemoryCommand
Function.	Command to execute the parameter transfer from RAM to E ² PROM.	
GC10	BASIC	LoadDefaultsCommand
Function.	Command to initialize parameters. It loads the default drive parameters for a motor that has been previously selected with parameter MP1. See section Initialization and adjustment in this manual.	

H group. Hardware

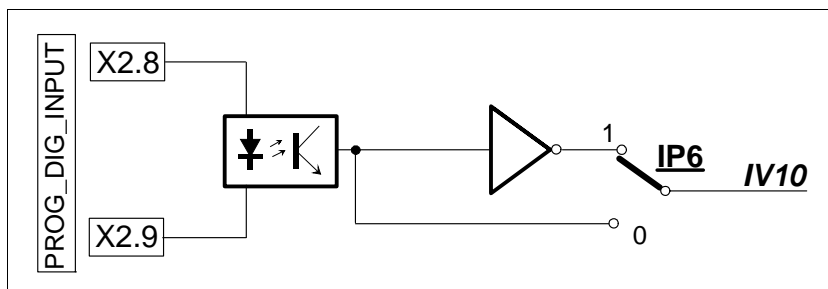
HV5	BASIC, RO	PLDVersion
Function.	Software version installed in the unit's PLD's	

I group. Inputs

IP6	USER	DigitalInputPolarity
------------	-------------	-----------------------------

Function. Sets the polarity (inverted or not inverted) of the programmable input (pins 8 and 9 of X2).

Valid values. **0/1** Not inverted (by default) / Inverted.



IP14	USER	DigitalInputFunctionSelector
-------------	-------------	-------------------------------------

Function. Determines the function assigned to the digital input of the unit. The programmable digital input (pins 8 and 9 of X2) is configured as remote input for resetting errors (IP14=04).

Valid values. 0, ..., 4.

BIT Nr.	Function	Description
00	InFunc0	Selecting the active feedback for the positioning drive depending on the digital input: Digital input to "0" → motor feedback Digital input to "1" → motor feedback
01	InFunc1	Reset of the integral action of the velocity loop
02	InFunc2	Invert the velocity command
03	InFunc3	Halt function (drive management)
04	InFunc4	Error reset (ResetClassDiagnostics, DC1=3)

Warning. If AP1=5, it will automatically select the InFunc0 function, i.e. IP14 = 0.

Default value. 4 (error reset).

IP17	USER	AnalogFunctionSelector
-------------	-------------	-------------------------------

Function. Determines the analog function assigned to the programmable analog input.

Valid values. 0, ..., 2.

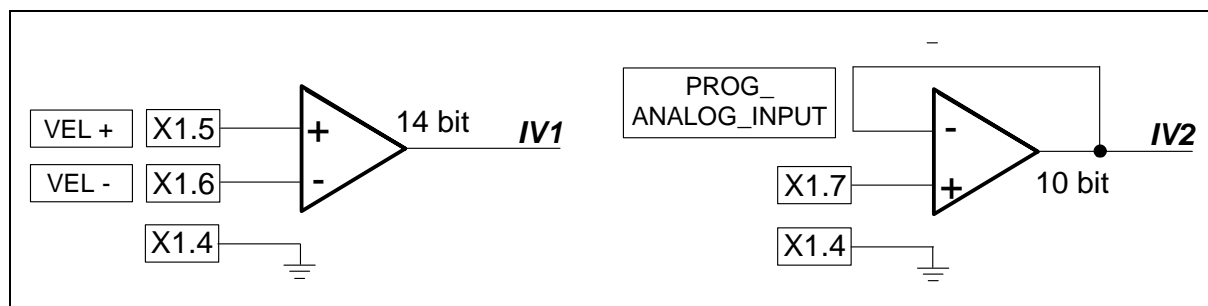
Default value. 0.

IV3 as input to function Nr

IP17	FUNCTION
00	There is no function
01	Func1
02	Func2

IV1	BASIC, RO	AnalogInput1
------------	------------------	---------------------

Function. Monitors the input voltage through analog input 1 (pins 5 - 6 of X1). It's display is in volts.



IV2	USER, RO	AnalogInput2
------------	-----------------	---------------------

Function. Monitors the input voltage through analog input 2 (pin 7 of X1). It's display is in volts.

IV3	USER, RO	CurrentCommandAfterScaling
------------	-----------------	-----------------------------------

Function. Contains the value of the auxiliary analog command (pin 7 of X1; usually current command) after being affected by CP10 and CP11. It must never exceed the value of the maximum current of the unit.

Valid values. - 50.00, ..., + 50.00 Arms.

IV10	USER, RO	DigitalInputs
-------------	-----------------	----------------------

Function. It shows the status of the programmable digital inputs at pins 8 - 9 of connector X2. The status of this variable is affected by IP6.

Valid values. 0 and 1.

IV11	USER, RO	DigitalInputsCh2
-------------	-----------------	-------------------------

Function. It contains a number whose binary code represents the status (active/inactive) of each digital input.

K group. Monitoring

KP3	USER	ExtBallastPower
------------	-------------	------------------------

Function. Contains the value of power of the external ballast resistor.

Valid values. 200, ..., 2000 W.

Default value. 200 W.

KP4	USER	ExtBallastEnergyPulse
Function.	Contains the value of the energy pulse that can be dissipated by the external ballast resistor.	
Valid values.	200, ..., 2000 J.	
Default value.	200 J.	
KV6	BASIC, RO	MotorTemperature
Function.	Motor temperature in degrees centigrade. For the time being, it is now only valid for the FKM family.	
Valid values.	- 20, ..., 150 °C.	
KV10	USER, RO	CoolingTemperature
Function.	Temperature of the heatsink of the power stage.	
Valid values.	0, ..., 105 °C.	
KV32	USER, RO	I2tDrive
Function.	Variable internally useful to the system. It measures the internal load level of the calculation of the i^2t at the drive in percentage used over the maximum.	
Valid values.	0, ..., 100 %.	
KV36	USER, RO	I2tMotor
Function.	Variable internally useful to the system. It measures the internal load level of the calculation of the i^2t at the motor in percentage used over the maximum.	
Valid values.	0, ..., 100 %.	
KV40	USER, RO	IntBallastOverload
Function.	Shows the load percentage on the ballast resistor in a drive. Useful for the i^2t protection of the resistor. A value greater than 100 % in this variable activates error E.314.	
Valid values.	0, ..., 100 %.	
KV41	USER, RW	BallastSelect
Function.	Selector that determines whether the ballast resistor is external or internal.	
Valid values.	0/1 External / Internal (by default).	

L group. Motion Control

LP22 FAGOR	JogVelocity
-------------------	--------------------

Function. It is used as value assigned to parameter V (VELOCITY) inside the MC application (*.mc) in the JOG module. Feedrate for all the movements in (JOG) mode.

Valid values. 0, ..., 6000 rev/min.

Default value. 1000 rev/min.

LP23 FAGOR	JogIncrementalPosition
-------------------	-------------------------------

Function. Distance moved per each movement in incremental jog mode with each up-flank of the JOG signals. It is used as the value assigned to parameter D (DISTANCE) in the incremental JOG movements programming in the jog module of the Motion Control program.

Valid values. 0, ..., 214 748 mm.

Default value. 1 mm.

LP48 FAGOR	PositionActionsSelect
-------------------	------------------------------

Function. The positioning drive's kernel may be governed remotely through ModBus using the drive's serial line.

The "hardware/software" may be selected either as a whole or individually. If the control selected is:

- Valid values.**
- 0** (hardware), the status of the "hardware inputs" dedicated to the kernel is reflected in its corresponding variable.
 - 1** (software), the status of the "hardware inputs" has no effect on its associated variable and the functionality of the variable is fully controlled by software.

See section: Process description

	bit 12	bit 11	bit 10	bit 9	bit 8	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0	Function
	x	x	x	x	x	x	x	x	x	x	x	0	0	all hardware
	x	x	x	x	x	x	x	x	x	x	x	0	1	all software
	0 [hard] [blocks]	0 [hard]	0 [hard]	0 [hard]	0 [hard]	0 [hard]	0 [hard]	0 [hard]	0 [hard]	0 [hard]	0 [hard]	1	x	individual control
	1 [soft] [OV11]	1 [soft] <input checked="" type="checkbox"/>	1 [soft] <input checked="" type="checkbox"/>	1 [soft] <input checked="" type="checkbox"/>	1 [soft]	1 [soft]	1 [soft]	1 [soft]	1 [soft]	1 [soft]	1 [soft]			

bits assigned to the inputs	Select Digital Outputs source	I_fast	Home Switch	Position Limit Select	1_2 cap. Select	Homing	Jog +, Jog -	Auto/Man	Reset	Start, Stop	S0-S4 Starting block			
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(x) Indifferent

Governed only by software using DeviceNet, CANopen and Profibus-DP protocol.

WARNING: When selecting the feedback change by hardware according to parameter LP48, parameter IP14 (DigitalInputFunctionSelector) will be automatically set to zero !

Default value. **0** (hardware)..

LP48. bit 12 This bit determines whether the OV11 variable reflects or not the value of the outputs programmed in the blocks table. Hence:

LP48.12 = 0 Physical digital outputs = OV11 = Outputs in the blocks program.

LP48.12 = 1 Physical digital outputs = OV11.

LP48. bit 13 This bit determines how the unit is enabled when it has a CAN DeviceNet™ or Profibus™ field bus as communication interface.

LP48.13 = 0 The unit has a CAN DeviceNet™ or Profibus™ field bus as communication interface, it is enabled using an "AND" logic between the digital inputs Drive Enable and Speed Enable and the <Enable> signals of the bus.

LP48.13 = 1 Enabling the unit depends only on the digital inputs Drive Enable and Speed Enable. When the unit has a CAN DeviceNet™ or Profibus™ field bus, the <Enable> signals of the bus are left out.

LP49 FAGOR InBandPosition

Function. Window that determines the position range where the INBAND event may be triggered in the positioning table.

Valid values. 0, ..., 214748.

Default value. 0.

LP143 FAGOR ModuleCommandMode

Function. On rotary axes and selecting the module format (see bit 7 of PP76), the interpretation of the position command depends on this parameter.

BIT Nr.	Meaning
15 (MSB), ..., 2	(reserved)
1, 0 (LSB)	= 00. Clockwise rotation
	= 01. Counterclockwise rotation
	= 10. Rotation via the shortest path (by default)
	= 11. Reserved

Valid values. 0, 1 and 2 (by default).

LV13 FAGOR, RW	KernelOperationMode
-----------------------	----------------------------

Function. It indicates which is the operating mode of the kernel.

Valid values. 0 Automatic mode (by default after starting up the drive).
1 Jog mode.

LV14 FAGOR, RW	KernelAutoMode
-----------------------	-----------------------

Function. It indicates which is the execution mode of the kernel for the automatic mode and for the jog mode.

Valid values. 0 Continuous (by default).
1 Single block.

LV15 FAGOR, RW	KernelStartSignal
-----------------------	--------------------------

Function. Digital signal whose up flank (transition from 0 to 1) starts the execution of the MC program in automatic or jog mode. Using the START signal to start the execution is always necessary after powering the system up or after activating the STOP or RESET signals. It is also necessary to generate an up flank of this signal to resume the execute when using the "single block" mode or the "instruction by instruction" mode.

Valid values. 0 Continuous (by default).
1 Single block.

LV16 FAGOR, RW	KernelStopSignal
-----------------------	-------------------------

Function. Digital signal whose up flank (transition from 0 to 1) momentarily interrupts the motion block and stops the motor. This signal does not complete the block, it only interrupts it so when the START **LV15 < KernelStartSignal >** is activated again, it goes on with the remaining portion of the block.

LV17 FAGOR, RW	KernelResetSignal
-----------------------	--------------------------

Function. Digital signal whose up flank (transition from 0 to 1) resets the execution of the Motion Control program. This signal stops the execution, restores the initial conditions and the drive is ready waiting for a new start-up signal **LV15 < KernelStartSignal >**.

LV19 FAGOR, RW	KernelManMode
-----------------------	----------------------

Function. It indicates which is the operating submode within the jog mode (LV13=1).

Valid values. 0 Continuous submode (by default).
1 Incremental submode.

LV20	FAGOR, RW	JogPositiveSignal
Function.	Digital signal used in the JOG module of the MC application (*.mc) to activate the jog movement in the positive direction.	
LV21	FAGOR, RW	JogNegativeSignal
Function.	Digital signal used in the JOG module of the MC application (*.mc) to activate the jog movement in the negative direction.	
LV35	FAGOR, RO	BlockTravelDistance
Function.	It returns the value of the total distance to travel of the current positioning block or that of the last one that has been executed if there is none in progress. Its value is updated every time a new positioning block is launched.	
Valid values.	- 214 748, ..., 214 748 mm.	
LV36	FAGOR, RO	BlockCoveredDistance
Function.	Variable that returns for a given instant the total distance traveled in the current positioning block or that of the last one that has been executed if there is none in progress. Its value is updated by the interpolator in each interpolation cycle.	
Valid values.	- 214 748, ..., 214 748 mm.	
LV158	FAGOR, RO	TargetPosition
Function.	Final position for the current positioning block. Note that in the current operating mode, the final position specified in the MOVE instruction being executed is copied to the LV158 < TargetPosition > variable.	
Valid values.	- 214748, ..., 214 748 mm or degrees.	
Units.	Degrees for rotary axes and mm for linear axes.	
LV159	FAGOR, RO	PositioningVelocity
Function.	Maximum positioning speed for the current positioning block (in module). Note that in the current operating mode, the positioning speed specified in the MOVE instruction being executed is copied to the LV159 < PositioningVelocity > variable.	
Valid values.	0, ..., 214 748 m/min.	
LV160	FAGOR, RW	PositioningAcceleration
Function.	Maximum acceleration applied to all the positioning blocks (in module).	
Valid values.	0, ..., 65 535 mm/s ² .	
Default value.	50 mm/s ² .	

LV161	FAGOR, RW	PositioningAcceleration2
--------------	------------------	---------------------------------

Function. Maximum acceleration applied to all the positioning blocks when using direct feedback.

Valid values. 0, ..., 65535 mm/s².

Default value. 50 mm/s².

LV242	FAGOR, RO	TargetPositionAttained
--------------	------------------	-------------------------------

Function. Mark indicating that the interpolator has reached the target position; in other words, it is activated when the position command PV47 <PositionCommand> reaches LV158 <Target-Position>.

Valid values. 0 and 1.

M group. Motor

MP1	BASIC	MotorType
------------	--------------	------------------

Function. Motor identification. The limits of certain parameters depend on the value of MP1 (e.g.: The upper limit of SP10 is 110 % of the motor rated speed) like its default parameter initialization through GC10. See command GC10. To govern a non-Fagor motor, insert the NULL value in the first field of MP1.

MP2	FAGOR	MotorTorqueConstant
------------	--------------	----------------------------

Function. Torque constant of the synchronous motor, (motor torque according to the rms current).

Valid values. 0.0, ..., 10.0 Nm/Arms.

Default value. 1.0 Nm/Arms.

MP3	FAGOR	MotorContinuousStallCurrent
------------	--------------	------------------------------------

Function. Motor rated current. Manipulating MP3 may affect parameter CP20 directly. See parameter CP20.

Valid values. 0.00, ..., 50.00 Arms. Depends on the motor connected.

Default value. 10.00 Arms.

N group. Linear axis configuration

NP117 FAGOR	ResolutionFeedback2
Function.	Resolution of the direct feedback device.
Units.	If it is a linear encoder, the feedback period signal is given in microns (μm). For FAGOR linear encoders (graduated glass) the resolution is 20 microns; in other words: NP117=20. If it is a rotary encoder, the resolution of the feedback signal is given in pulses per turn.
Valid values.	0, ..., 65 535.
Default value.	4096 ppt of the rotary encoder.
NP118 FAGOR	ResolutionOfLinearFeedback
Function.	Resolution of the linear encoder used as direct feedback. This parameter is ignored for a rotary feedback device. If the feedback signal is modified by an external multiplier, the value must reflect its effect.
Units.	The period of the feedback signal is given in microns (μm). For FAGOR linear encoders (graduated glass) the resolution is 20 μm ; in other words: NP118=20. For Fagor steel-tape-based linear encoders, the resolution is 100 m, that is: NP118=100. If a x5 multiplying factor is applied to a Fagor linear encoder COVX (20 μm), then NP118 = 4.
Valid values.	0, ..., 6553.5 μm .
Default value.	20 μm .
NP121 FAGOR	InputRevolutions
NP122 FAGOR	OutputRevolutions
Function.	They define the gear ratio between the motor shaft and the final axis moved by the machine. For example, if 5 turns of the motor shaft mean 3 turns of the machine leadscrew, the value of these parameters is: NP121 = 5, NP122 = 3
Valid values.	1, ..., 65535 turns.
Default value.	1 turn in both parameters (direct coupling).
NP123 FAGOR	FeedConstant
Function.	It defines the gear ratio between the linear movement of the machine and the axis moving it. For example, if every turn of the leadscrew means a 4 mm displacement of the table, the value for this parameter is:

NP123 = 4

If it is a rotary axis: **NP123 = 360** (360° per turn).

Valid values. 0, ..., 214748 mm.

Default value. 5000 µm (5mm per turn).

NP131 FAGOR	InputRevolutions2
--------------------	--------------------------

NP132 FAGOR	OutputRevolutions2
--------------------	---------------------------

Function. They define the gear ratio between the direct feedback and the movement of the load.

For example, if 5 turns of the encoder shaft of the direct feedback are due to 3 turns of the machine leadscrew, the value of these parameters must be:

NP131 = 5, NP132 = 3

Valid values. 1, ..., 65535 turns.

Default value. 1 turn in both parameters (direct coupling).

NP133 FAGOR	FeedConstant2
--------------------	----------------------

Function. It defines the lineal displacement per each turn of the direct feedback encoder.

For a rotary machine:

NP133 = 0 (it makes no sense in this application).

For a linear machine with direct linear feedback::

NP133 = 0 (it makes no sense in this application).

For a linear machine with direct rotary feedback::

If **R1=R2, NP133 = 0**

The linear movement versus the number of turns of both encoders is the same.

If **R1≠R2, NP133≠ 0**

NP133 must be set so the feedback is properly defined.

If **NP133 = 0**

Assume the value given in **NP123** as the leadscrew pitch.

Valid values. 0, ..., 214768 mm.

Default value. 5 mm.

Example I.

Motor with toothed belt and gear ratio of 1: 2, leadscrew pitch of 10 mm and external encoder mounted on the leadscrew.

NP121 = 1, NP122 = 2, NP123 = 10 mm

NP131 = 1, NP132 = 1, NP133 = 10 mm (it may be left as zero)

Example II.

Motion Control application (cylindrical rollers) with measuring wheel.

Moving distance for the rollers: **NP121 = 5, NP122 = 2, NP123 =100 mm**

Moving distance for the wheel: **NP131 = 1, NP132 = 1, NP133 =314.15 mm**

MOTOR FEEDBACK and TABLE LEADSCREW

Example III.

Rotary axis with 40:1 gear reduction and external encoder attached with a toothed belt whose gear ratio is 2:1.

NP121 = 40, NP122 = 1, NP123 = 360° per turn

NP131 = 2, NP132 = 1, NP133 = 360° per turn

There is no need to enter values in **NP123** or in **NP133** when using rotary axes. Internally, they will both assume the values of **360° per turn**.

O group. Analog and digital outputs

OP1	USER	DA1IDN
------------	-------------	---------------

OP2	USER	DA2IDN
------------	-------------	---------------

Function. They identify the internal analog variables of the drive that will be reflected at the electrical outputs and will be affected by the OP3 and OP4 gains respectively. Channel 1 (pin 8 of X1) and channel 2 (pin 9 of X1).

Valid values. Name of any parameter or variable of the table.

Default value. 04 for OP1 and 07 for OP2.

OP1	VARIABLE	NAME	OP2	VARIABLE	UNITS
00	SV15	DigitalVelocityCommand	00	SV15	rev/min
01	SV1	VelocityCommand	01	SV1	
02	SV6	VelocityCommandAfterFilter	02	SV6	
03	SV7	VelocityCommandFinal	03	SV7	
04	SV2	VelocityFeedback	04	SV2	dNm
05	TV1	TorqueCommand	05	TV1	
06	TV2	TorqueFeedback	06	TV2	cA
07	CV3	CurrentFeedback	07	CV3	
09	IV1	AnalogInput1	09	IV1	mV
10	IV2	AnalogInput2	10	IV2	
11	RV1	FeedbackSine	11	RV1	bits
12	RV2	FeedbackCosine	12	RV2	
13	PV189	FollowingError	13	PV189	dµm or m°

OP3	USER	DA1ValuePer10Volt
------------	-------------	--------------------------

OP4	USER	DA2ValuePer10Volt
------------	-------------	--------------------------

Function. They define the gain of channel 1 (pin 8 of X1) and channel 2 (pin of X1). There are 10 V at these outputs when the selected variable reaches this value.

Units. µm (linear axis), m° (rotary axis).

Valid values. 0, ..., 9999.

Default value. 4000 and 3000 respectively.

Example. If OP1=04(SV2)(VelocityFeedback), in rev/min & OP3=3000. It means that when the value of SV2 is 3000 rev/min the analog

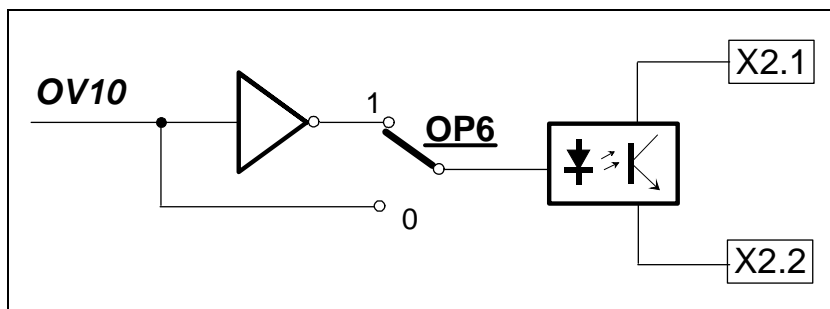
output will be 10 V and it maintains this rpm/V ratio throughout its full range $\pm 10V$.

OP6	USER	DigitalOutputPolarity
------------	-------------	------------------------------

Function. Polarity (inverted or not inverted) of the programmable digital input (pins 1 and 2 of X2).

Valid values. **0/1** Not inverted / inverted

Default value. **0** Not inverted.



OP14	USER	DigitalOutputFunctionSelector
-------------	-------------	--------------------------------------

Function. They determine the activation of the various outputs of the digital functions available.

FUNCTION	OP14
OutFunc0	00
OutFunc1	01
OutFunc2	02
OutFunc3	03

FUNCTION	OP14
OutFunc4	04
OutFunc5	05
OutFunc6	06
OutFunc7	07

OV10 as output of function Nr

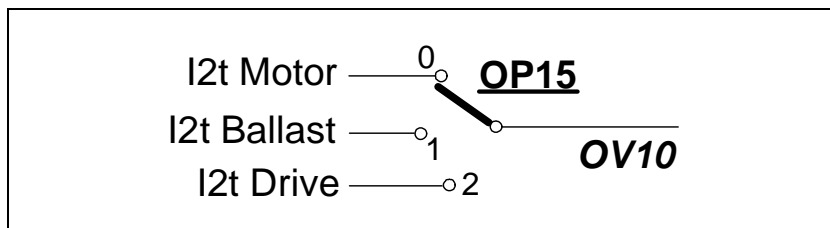
OP15	USER	DigitalOutputWarningSelector
-------------	-------------	-------------------------------------

Function. Selector of the warning that will be displayed by the programmable output when function OutFunc7 is selected.

Valid values. **0** → I²tMotor (by default)

1 → I²tBallast

2 → I²tDrive



OV10	USER, RO	DigitalOutputs
-------------	-----------------	-----------------------

Function. It contains the value of the output status of the various functions that may be selected with OP14.

Valid values. 0 and 1.

OV11	USER, RW	DigitalOutputsCh2
-------------	-----------------	--------------------------

Function. Depending on the value of bit 12 of parameter LP48:
LP48.bit 12 = 0 → OV11 contains a number whose binary code (low portion only, the high portion is reserved) represents the status of the digital outputs (connector X5).
LP48.bit 12 = 1 → OV11 governs the status of the digital outputs (connector X5).
 See parameter LP48 for further detail.

P group. Position loop

PP1	FAGOR	HomingVelocitySlow
------------	--------------	---------------------------

Function.	It sets the low speed of the homing process controlled from the drive itself. This parameter is necessary when the home search is controlled from the drive, PC148 <Drive Controlled-Homing > active.
Valid values.	0, ..., 6000 rev/min of the motor.
Default value.	100 rev/min of the motor.

PP41	FAGOR	HomingVelocityFast
-------------	--------------	---------------------------

Function.	It sets the high speed of the homing process controlled from the drive itself. This parameter is necessary when the home search is controlled from the drive, PC148 < Drive Controlled-Homing > active.
Valid values.	0, ..., 6000 rev/min of the motor.
Default value.	200 rev/min of the motor.

PP42	FAGOR	HomingAcceleration
-------------	--------------	---------------------------

Function.	It sets the acceleration applied in the homing process controlled from the drive itself. This parameter is necessary when the home search is controlled from the drive, PC148 <DriveControlled Homing > active.
Valid values.	0, ..., 65535 rad/s ² .
Default value.	20 rad/s ² .

PP49	FAGOR	PositivePositionLimit
-------------	--------------	------------------------------

PP50	FAGOR	NegativePositionLimit
-------------	--------------	------------------------------

Function.	<p>They delimit the area permitted for the movements of the axis.</p> <p>These limits are only taken into account if a home search has been carried out before; in other words, bit 0 of PV203 <PositionFeedbackStatus> is set to "1" (the PC148 <DriveControlledHoming> command has been executed).</p> <p>If the PV47 < PositionCommand> variable generates an axis movement that takes it beyond the permitted zone, it will activate the warnings 500 (if beyond the positive limit) or 501 (if beyond the negative limit).</p> <p>If the LV158 < TargetPosition > variable exceeds the position limits, the drive activates bit 13 (TargetPosition OutsideThe-TravelZone) of DV158 <Class2Diagnostics (Warnings)>.</p>
------------------	---

Valid values. - 214 748, ..., 214 748 mm.
Default values. For linear axes:
PP49 = 214748 mm y PP50 = - 214748 mm
For rotary axes:
PP49 = 214748° y PP50 = - 214748°

PP52	FAGOR	ReferenceDistance1
-------------	--------------	---------------------------

Function. With motor feedback, this parameter sets the distance between the machine reference zero and the machine reference point. It is similar to parameter REFVALUE (P53) of the axes of the 8055/55i CNC.

Valid values. - 214748, ..., 214748 mm.

Default value. 0.

PP54	FAGOR	ReferenceDistance2
-------------	--------------	---------------------------

Function. With direct feedback, this parameter sets the distance between the machine reference zero and the machine reference point. It is similar to parameter REFVALUE (P53) of the axes of the 8055/55i CNC

Valid values. - 214748, ..., 214748 mm.

Default value. 0.

PP55	FAGOR	PositionPolarityParameters
-------------	--------------	-----------------------------------

Function. 16-bit register that may be used to activate or deactivate the position limits and invert or not the sign of the position command value. On rotary motors, if the sign of the position command variations is positive, the motor will turn clockwise.

BIT Nr.	Meaning
15 (MSB), ..., 5	(reserved)
4	Status of the position limits. = 0. Not active = 1. Active (by default). See PP49 and PP50.
3	Reserved
2	Reserved
1	Reserved
0 (LSB)	Sign of the position command value = 0. Not inverted = 1. Inverted (by default)

PP57	FAGOR	PositionWindow
-------------	--------------	-----------------------

Function. It sets the difference allowed between the actual position and the target position LV158 <TargetPosition> so the motor-drive system may be considered to be in position.

Valid values. - 214748, ..., 214 748 mm for linear axes and degrees for rotary axes.

Default value. 2 mm for linear and 2 degrees for rotary over 360°.

PP76	FAGOR	PositionDataScalingType
-------------	--------------	--------------------------------

Function. 16-bit register that configures the measuring scale for the positioning. All the bits must be set to zero, except bit 6 that will always be set to "1" and bit 7 (1 or 0) to either activate or not the module format on the commands received.

BIT Nr.	Meaning
15 (MSB), ..., 8	(reserved). All zero.
7	Format = 0. Absolute (by default) = 1. Module. See PP103.
6, ..., 2	Reserved
1, 0 (LSB)	Position command scaling method = 01. Linear (by default) = 10. Rotary

PP103	FAGOR	ModuleValue
--------------	--------------	--------------------

Function. Module value. If bit 7 of parameter PP76 selects the module format, this parameter defines the work range of the position.

Valid values. 0, ..., 214 748 degrees.

Default value. 360 degrees (normally used on rotary axes).

PP104	FAGOR	PositionKvGain
--------------	--------------	-----------------------

Function. It sets the value of the proportionality constant Kv in the position loop. It is similar to parameter PROGAIN (P23) of the axes of the 8055/55i CNC It is given in m/min of programmed velocity command per mm of following error.

Valid values. 0, ..., 65 535 (m/min)/mm..

Default value. 10 (following error of 1 mm for a feedrate of F1000).

Example.
PP104=10 means that a following error of 1 mm is obtained with a programmed feedrate of 1000 mm/min (F1000 at the CNC).

PP104=20 means that a following error of 0,5 mm is obtained at a feedrate of F1000 programmed at the CNC.

To obtain a following error of 500 µm, for a F2500, the Kv will be 2500/500, i.e. **PP104 = 5**.

PP105 FAGOR	PositionKvGain2
--------------------	------------------------

Function. It sets the value of the proportionality constant Kv in the position loop when using direct feedback. It is given in m/min of programmed velocity command per mm of following error.

Valid values. 0, ..., 65535 (m/min)/mm..

Default value. 10 (following error of 10 mm for a feedrate of F1000).

PP115 FAGOR	PositionFeedback2Type
--------------------	------------------------------

Function. It sets the various aspects of direct feedback. Bit 3 can be used to solve a positive feedback problem (axis runaway).

BIT Nr.	Meaning
15 (MSB), ..., 4	(reserved).
3	Feedback direction
	=0 Not inverted
	=1 Inverted.
2, 1	Reserved
0 (LSB)	Feedback type
	=0 Rotary. See NP117.
	=1 Linear.

PP147 FAGOR	HomingParameters
--------------------	-------------------------

Function. It is a 16-bit register that sets the mechanical and electrical relationship between the homing procedure and the machine installation, the CNC or the drive. When the home search is controlled by the drive, only bits 0, 1, 2, 3, 5, 6 and 7 will be applicable. When the home search is controlled by the CNC only bits 1, 2, 3 and 4 are applicable.

BIT Nr.	Meaning
15 (MSB), ..., 8	(reserved).
7	Position after the drive controlled homing procedure (reserved)
6	Evaluation of the reference mark (I0) (reserved)
	=0 The reference mark of the motor feedback is evaluated (by default).
	=1 The reference mark of the motor feedback is not evaluated.
5	Evaluation of the home switch
	=0 The home switch is evaluated (by default).
	=1 The home switch is not evaluated.
4	Interpretation at the drive (reserved)

3	Feedback
	=0 Motor (by default).
	=1 Direct.
2	Home switch connection (reserved).
1	Home switch signal logic.
	=0 Pressing the home switch sets the PLC input to 1 (positive logic, by default).
	=1 Pressing the home switch sets the PLC input to 0.
0 (LSB)	Moving direction.
	=0 Positive. The motor shaft turns clockwise (by default).
	=1 Negative. The motor shaft turns counterclockwise.

PP159 FAGOR	MonitoringWindow
--------------------	-------------------------

Function. It sets the permissible following error range. If it is greater than the value given by this parameter, the drive issues E156 (too much following error). If=0, the following error will not be monitored.

<p>Warning. It is important to set PP159 to a value other than zero to prevent the axes from running away. The CNC also monitors the maximum following error allowed by setting its corresponding parameter in the parameter table of each axis at the CNC.</p>
--

Valid values. 0, ..., 214748 mm for linear movements.
0, ..., 214748 degrees for rotary movements.
Remember that if **PP159=0**, the following error will not be monitored.

Default value. 3 mm for linear and 3 degrees for rotary over 360°.

PP216 FAGOR	VelocityFeedForwardPercentage
--------------------	--------------------------------------

Function. It sets the amount of velocity feedforward being applied. It is similar to parameter FFGAIN (P25) of the axes of the 8055/55i CNC. It indicates the % of velocity command anticipated to the movement and it does not depend on the amount of following error (open loop).

Valid values. 0, ..., 120 %.

Default value. 0 % (feed-forward not applied).

PP218 FAGOR	VelocityFeedForwardPercentage2
--------------------	---------------------------------------

Function. It sets the amount of velocity feedforward being applied when using direct feedback. It indicates the % of velocity command anticipated to the movement and it does not depend on the amount of following error (open loop).

Valid values. 0, ..., 120 %.

Default value. 0 % (feed-forward not applied).

PV47	FAGOR, RO	PositionCommand
-------------	------------------	------------------------

Function. Position command applied to the position loop in each cycle of the control loop. The drive transfer a value to the CNC for display.

Valid values. - 214 748, ..., 214 748 mm (linear) or degrees (rotary).

PV51	FAGOR, RO	PositionFeedback1
-------------	------------------	--------------------------

PV53	FAGOR, RO	PositionFeedback2
-------------	------------------	--------------------------

Function. The drive transfer this data to the CNC to display the position command, the position feedback through the motor feedback (PV51) and through the direct feedback (PV53).

Valid values. - 214 748, ..., 214 748 mm (linear) or degrees (rotary).

PV173	USER, RO	MarkerPositionA
--------------	-----------------	------------------------

Function. In the home searching process, when the drive detects the I0 signal, it saves the value of the PositionFeedback1/2 (not yet homed) in this variable

Valid values. - 214 748, ..., 214 748 mm (linear) or degrees (rotary).

PV189	FAGOR, RO	FollowingError
--------------	------------------	-----------------------

Function. This variable registers the difference between the position command and the position feedback. $PV189 = PV47 - PV51/53$

$FollowingError = PositionCommand - PositionFeedback1/2$

Units. μm for linear movements and tenth-thousandths of a degree for rotary movements.

PV200	FAGOR, RO	HomeSwitch
--------------	------------------	-------------------

Function. This binary parameter represents the logic state of the home switch. For that, this variable must be associated with one of the digital inputs of the drive that will be connected to the switch.

Valid values.
0 Switch inactive.
1 Switch on. The axis is positioned on the switch.

PV208	FAGOR, RO	ReferenceMarkerPulseRegistered
--------------	------------------	---------------------------------------

Function. This binary variable is activated when the drive detects the reference mark (I0) during home search.

Valid values. 0 and 1.

PC148 USER	DriveControlledHoming
-------------------	------------------------------

Function. Command that activates the home search.

PC150 BASIC	ChangePosFB12
--------------------	----------------------

Function. Feedback changing command.

Only effective if:

- ❑ The control of the digital inputs (see parameter LP48) is all hardware but the IP14 value is other than zero.
- ❑ The control of the digital inputs is individual (see parameter LP48), but bit 8 is set to "1" (control by software).

Q group. Communication

QP14	USER	ProtocolTypeSelector
-------------	-------------	-----------------------------

Function. Determines which hardware communication mode has been established (RS232, RS485, RS422) with ModBus communication protocol and it is established through the serial "COMMUNICATIONS". line connector.

Valid values. 2, 3 and 4.

Value	ModBus
2	RTU & RS232
3	RTU & RS485
4	RTU & RS422

Default value: 2. RTU & RS232.

QP16	USER	SerialSetting
-------------	-------------	----------------------

Function. Sets the communications parameters of the UART (Universal Asynchronous Receiver/Transmitter) of the serial line: baudrate, parity, Nr of bits, Nr of stop bits.

BIT Nr.	Meaning
15 (MSB), ..., 12	(reserved).
11, 10	Stops bits
	= 1. Stop bit
	= 2. Stop bit
9, ..., 6	Data bits
	= 7. Data bits
	= 8. Data bits
5, 4	Parity
	= 0. No parity
	= 1. Even parity
3, ..., 0 (LSB)	Communication speed (baudrate)
	= 0. Reserved = 4. 9600
	= 1. Reserved = 5. 19200
	= 2. Reserved = 6. 38400
	= 3. Reserved

Default value. 1540 (9600, no parity, 8 data bits, 1 stop bit).

Warning. The communication rate cannot be lower than 9600 baud; therefore the minimum value for QP16 is 4.

QV22	FAGOR, RO	IDNListOfInvalidOperationDataForCP3
-------------	------------------	--

Function. Variable containing the parameters that are readjusted by the drive when it issues the error E.502 (incompatible parameters). The parameters are listed by their bus identifier.

Valid values. Any parameter bus identifier.

QV96	USER, RW	SlaveArrangement
-------------	-----------------	-------------------------

Function. It contains the number of the node assigned to the drive for communication.

Valid values. 0, ..., 127.

Value	ModBus protocol
0	Number Nr 0 (normally cannot be used)
1, ..., 127	Node Nr assigned to the unit in a bus type communication

R group. Rotor sensor

RP1	FAGOR	FeedbackSineGain
------------	--------------	-------------------------

RP2	FAGOR	FeedbackCosineGain
------------	--------------	---------------------------

Function. Compensation (proportional gain mode) of the amplitude of the sine/cosine signal that goes from the motor feedback to the drive. Entering 4096 is the same as multiplying by 1. To assign a gain of 1.5 to the sine signal, set RP1 to 6144 (= 4096 x 1.5).

Valid values. 0 (0 %), ..., 8192 (200 %).

Default value. 4096 (100 %).

RP3	FAGOR	FeedbackSineOffset
------------	--------------	---------------------------

RP4	FAGOR	FeedbackCosineOffset
------------	--------------	-----------------------------

Function. Compensation (offset mode) of the sine/cosine signal that goes from the motor feedback to the drive.

Valid values. - 2000, ..., 2000.

Default value. 0.

RV1	USER, RO	FeedbackSine
------------	-----------------	---------------------

RV2	USER, RO	FeedbackCosine
------------	-----------------	-----------------------

Function. Sine and cosine of the feedback that goes from the motor to the drive as internal system variables.

Valid values. - 512, ..., 511.

RV3	FAGOR, RO	FeedbackRhoCorrection
------------	------------------	------------------------------

Function. Corrects the phase shift between the encoder shaft and the motor shaft. The motors are factory set and the value of this variable is stored in the encoder memory.

Valid values. 0, ..., 6553.

RC1	FAGOR	EncoderParameterStoreCommand
------------	--------------	-------------------------------------

Function. Command that could be used to store the content of MP1 and RV3 in the E²Prom of the SinCos™ or SinCoder™ encoder.

S group. Velocity

SP1	BASIC	VelocityProportionalGain
------------	--------------	---------------------------------

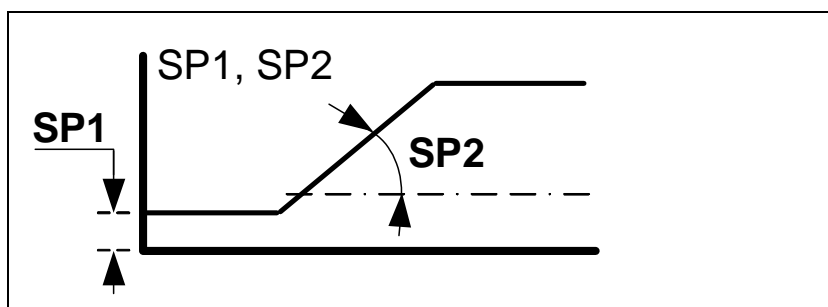
SP2	BASIC	VelocityIntegralGain
------------	--------------	-----------------------------

Function. Value of the proportional / integral action of the velocity PI.

Valid values. **SP1:** 0, ..., 999.9 mArms/rpm.

SP2: 0.1, ..., 999.9 ms.

Default value. Depends on the motor-drive combination.



SP3	BASIC	VelocityDerivativeGain
------------	--------------	-------------------------------

Function. Value of the derivative action of the velocity PI.

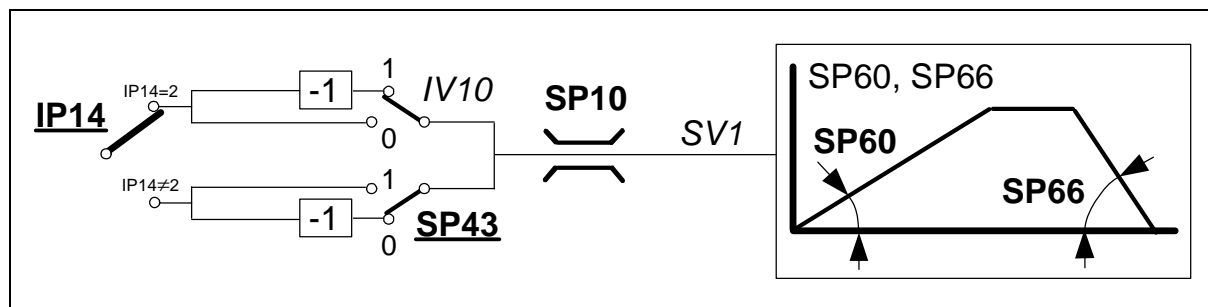
Valid values. SP3: 0 (by default), ..., 9999.

SP10	BASIC	VelocityLimit
-------------	--------------	----------------------

Function. Maximum velocity limit for SV7 (VelocityCommandFinal).

Valid values. 0, ..., 110 % motor rated speed in rev/min.

Default value. 1000 rev/min.

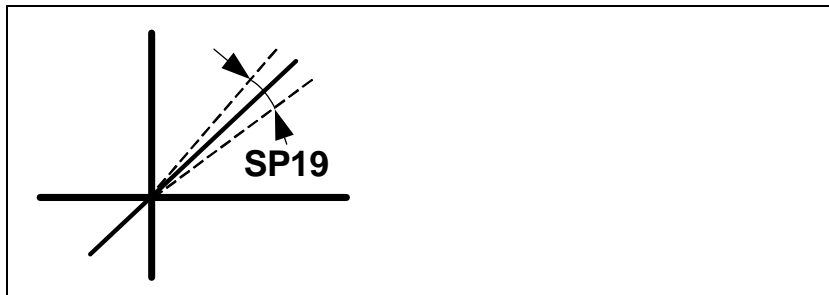


SP19	BASIC	SymmetryCorrection
-------------	--------------	---------------------------

Function. Its purpose is to correct the possible deviation of the analog command generated to obtain exactly the same speed in both turning directions.

Valid values. - 500, ..., 500 mV.

Default value. 0 mV.

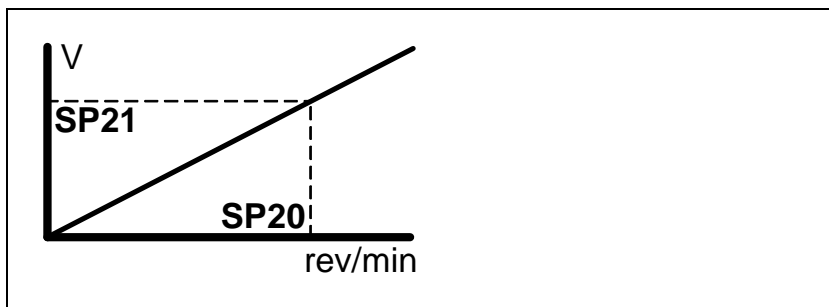


SP20	BASIC	VoltageRpmVolt
-------------	--------------	-----------------------

Function. Parameter SP20 and SP21 set the necessary ratio between the analog command and the motor speed. They correspond to the reference of the CNC concept G00 Feed.

Valid values. 1.00,..., 10.00 V.

Default value. 9.5 V.



SP21	BASIC	RpmRpmVolt
-------------	--------------	-------------------

Function. See parameter SP20.

Valid values. 10, ..., motor rated speed in rev/min.

Default value. Motor rated speed in rev/min.

SP30	BASIC	VelocityOffset
-------------	--------------	-----------------------

Function. Correction of the analog velocity command offset It is applied after the analog input is treated by SP19, SP20 and SP21.

Valid values. - 2000, ..., +2000 rev/min x 10⁻²

Default value. 0 rev/min x 10⁻².

SP40	USER	VelocityThresholdNx
-------------	-------------	----------------------------

Function. Velocity level over which the OV10 variable is activated when function OutFunc3 (MotorSpeed > SP40) is active.

Valid values. 0, ..., motor rated speed in rev/min.

Default value. 1000 rev/min.

SP41	USER	VelocityWindow
-------------	-------------	-----------------------

Function. Velocity window assigned to the "reached speed" function. It is used to know when the speed of a motor (variable SV2) has reached the supplied command (variable SV7) within the margins of this window SP41.

Valid values. 0, ..., 12% of parameter SP10 (speed limit in rev/min).

Default value. 20 rev/min.

SP42	USER	StandStillWindow
-------------	-------------	-------------------------

Function. It sets the value of the velocity window around zero that may be considered to be zero speed.

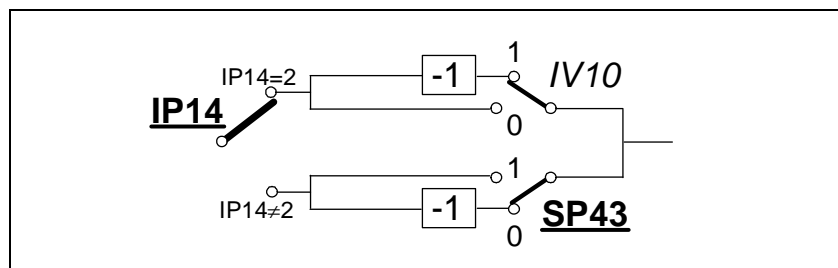
Valid values. 0, ..., motor rated speed in rev/min.

Default value. 20 rev/min.

SP43	BASIC	VelocityPolarityParameter
-------------	--------------	----------------------------------

Function. This parameter is used to change the sign of the velocity command in specific applications. **This parameter cannot be used to solve a positive feedback problem (axis run-away).**

Valid values. 0 / 1. Not inverted (by default) / inverted.

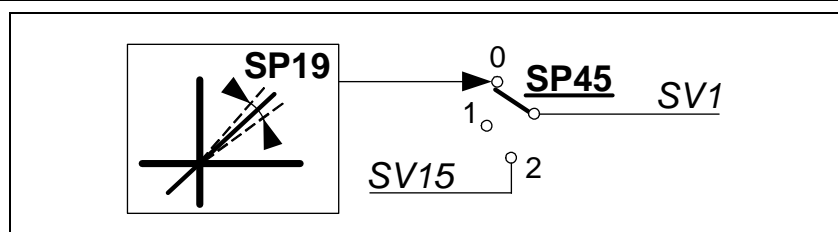


SP45	BASIC	VelocityCommandSelector
-------------	--------------	--------------------------------

Function. It sets the source of velocity command.

Valid values. 0 (by default), 1 and 2.

Value	Function
0	Analog. Input through pins 5 and 6 of connector X1 after being adapted by SP19, SP20 and SP21.
1	Reserved
2	Digital. Value of SV15.

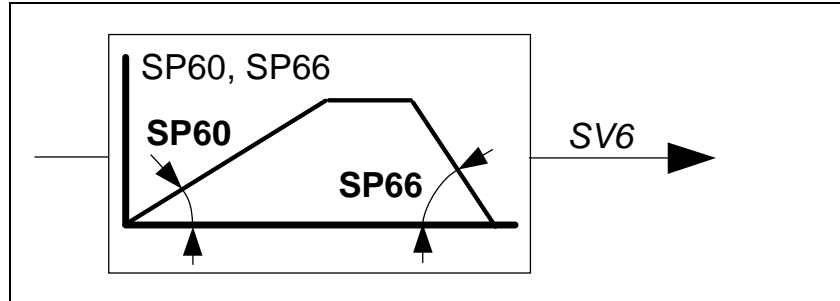


SP60 BASIC**VelocityAccelerationTime****Function.**

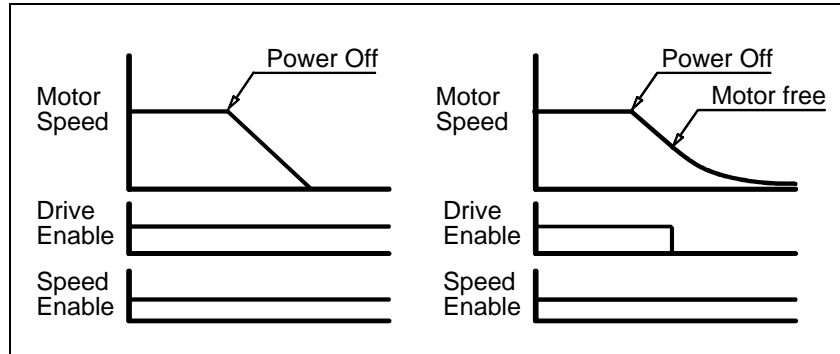
It sets the acceleration ramp applied to the velocity command. Setting it with a 0 value means that no ramps will be applied.

Valid values.

0.0 (by default), ..., 400.0 (rev/min)/ms.

**SP65 BASIC****EmergencyAcceleration****Function.**

During an emergency stop, if the bus voltage drops or there is a power outage for the unit in the acceleration, deceleration or constant power mode, the drive will get into the dynamic braking sequence. It will stop with the emergency ramp until its speed is zero as long as the mechanical energy stored in the motor allows it.



Therefore, it will limit the command acceleration for stopping the motor. If anytime during the sequence, the Drive Enable is interrupted, the motor will turn by inertia. SP65=0 cancels this limiting effect.

Valid values.

0.0, ..., 400.0 (rev/min)/ms.

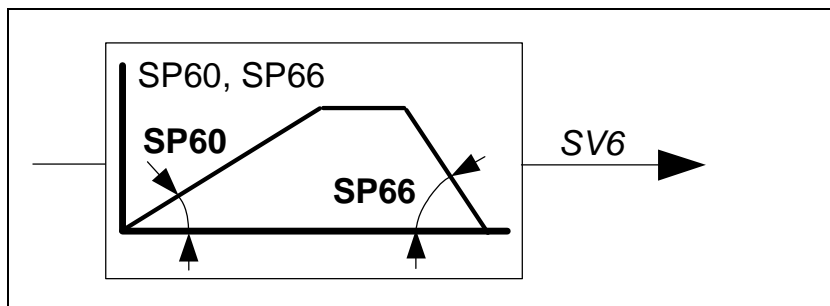
Default value.

0.0.

SP66	BASIC	VelocityDecelerationTime
-------------	--------------	---------------------------------

Function. It sets the deceleration ramp applied to the velocity command. Setting it with a 0 value means that no ramps will be applied.

Valid values. 0.0 (by default), ..., 400.0 (rev/min)/ms.



SV1	BASIC, RW	VelocityCommand
------------	------------------	------------------------

Function. Velocity command after the SP45 selector.

Valid values. - 6000, ..., 6000 rev/min.

SV2	BASIC, RO	VelocityFeedback
------------	------------------	-------------------------

Function. Velocity feedback.

Valid values. - $6E+7$, ..., $6E+7$ (rev/min) $\times 10^{-4}$.

SV6	BASIC, RO	VelocityCommandAfterFilters
------------	------------------	------------------------------------

Function. Velocity command after applying limits, ramps, etc.

Valid values. - 6000, ..., 6000 rev/min.

SV7	BASIC, RO	VelocityCommandFinal
------------	------------------	-----------------------------

Function. Final velocity command applied to the loop.

Valid values. - 6000, ..., 6000 rev/min.

SV15	USER, RW	DigitalVelocityCommand
-------------	-----------------	-------------------------------

Function. Digital velocity command.

Valid values. - 6000, ..., 6000 rev/min.

T group. Torque and power

TP1	USER	TorqueThesholdTx
------------	-------------	-------------------------

Function. It sets the threshold for the activation of OV10 when function OutFunc2 (TorqueLimitModeCeroSearch) is activated.

Units. Fraction of the rated value of the motor torque.

Valid values. 0, ..., 100 %.

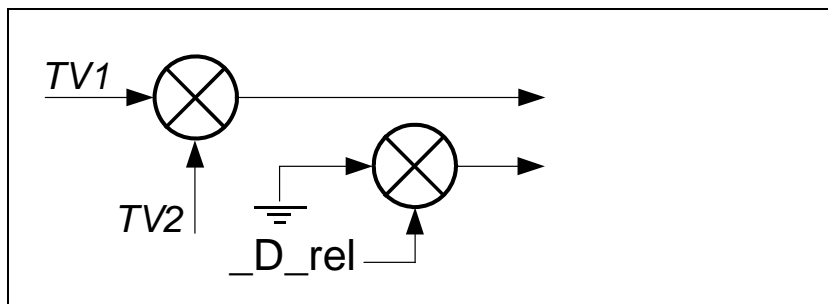
Default value. 5 %.

TV1	USER, RO	TorqueCommand
------------	-----------------	----------------------

TV2	USER, RO	TorqueFeedback
------------	-----------------	-----------------------

Function. Displays the values of the command and torque feedback.

Valid values. - 99.9, ..., + 99.9 Nm.



DEDICATED PLC REGISTERS

Notation used

< RG > < Index > where:

RG: Character identifying the dedicated PLC register.

Index. Register identifier number

There are the following registers:

RG1	USER, RW	PiecesCount
------------	-----------------	--------------------

Function. Counter for the number of parts to be made.

Valid values. 0, ..., 65535 < number of parts >.

Default value. 0.

RG2	USER, RW	ActualPiecesCount
------------	-----------------	--------------------------

Function. Counter for the number of parts that have been made so far.

Valid values. 0, ..., 65535 < number of parts >.

Default value. 0.

RG3	USER, RW	RunningBlock
------------	-----------------	---------------------

Function. Register that reflects the number of the block being executed.

Valid values. 1, ..., 127.

Default value. 1.

RG4	USER, RW	PositionBlockIni
------------	-----------------	-------------------------

Function. Register that reflects the number of the block to be executed after activating the START input.

Valid values. 1, ..., 127.

Default value. 1.



Note that it is possible to access any register or positioning block of the table through the serial communication line RS232/RS422/RS485 using the Mod-Bus protocol with any device acting as MASTER like, for example, an ESA video terminal.

ERROR MESSAGES

E.001	Internal	
--------------	-----------------	---

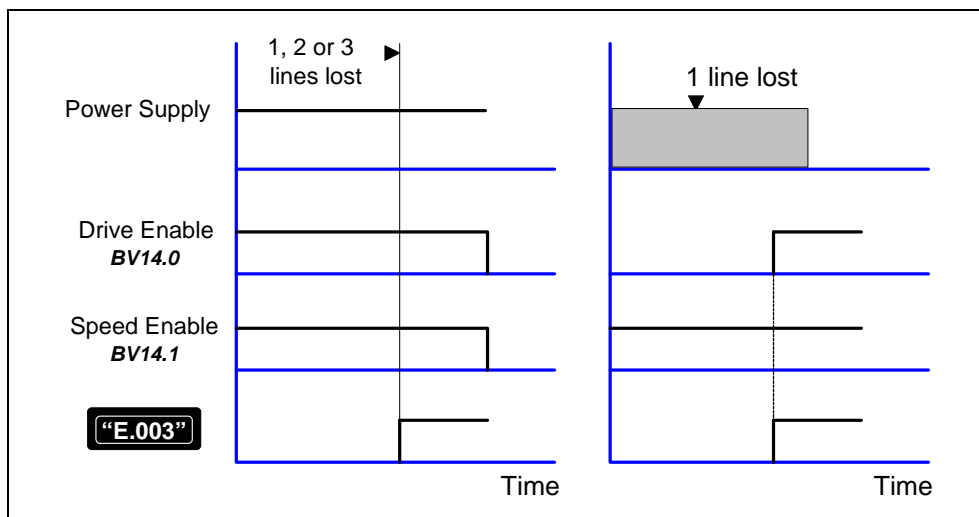
Contact Fagor Automation.

E.003	At the power bus voltage	
--------------	---------------------------------	---

Cause. When having torque, one of the phases of the line may have dropped.

Warning. Any power-up failure related to the supply of power or the fact that the connector of the Ballast resistor has not been connected or it has opened will be warned with warning W.003.

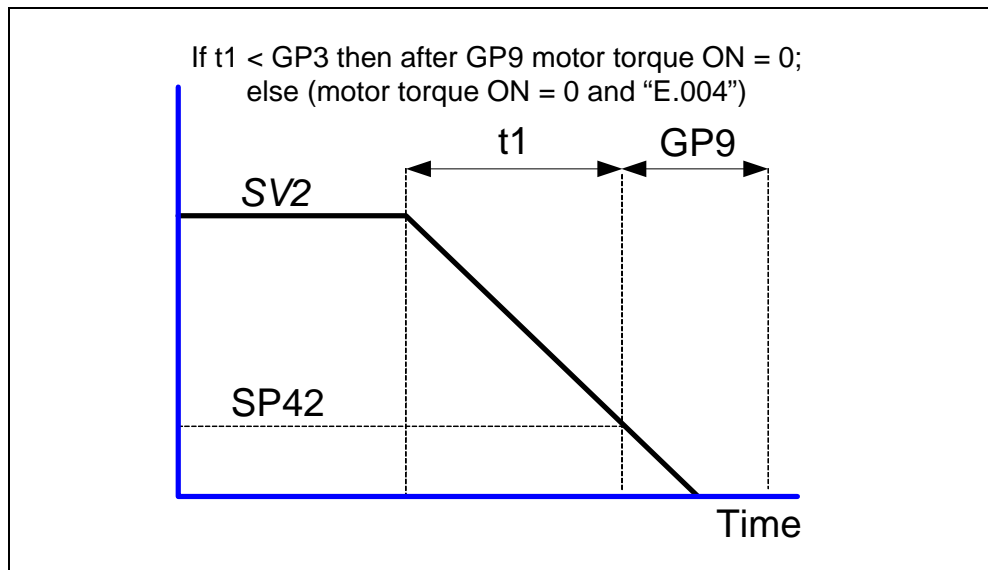
Solution. Check that the line phases and the drives are OK in the direction indicated earlier and start the system back up.



E.004	Emergency stop exceeding time limit GP3	
--------------	--	---

Cause. An attempt has been made to stop the motor by canceling **Speed Enable**. The system has tried to stop the motor at full torque, but it has not been able to stop it in the time frame set by parameter GP3 (**StoppingTimeout**=maximum time allowed for braking, before considering the error for being unable to stop it in the set time) or the parameter that determines when the motor is considered to be stopped (SP42) **Minimum velocity threshold**, is too small.

Bear in mind that zero speed (total lack of velocity) does not exist, there is always a minimum amount of speed noise due to feedback.



- Solution.** The load that must stop the motor is too large to stop it in the time frame set by GP3 and the value given to this parameter must be increased.
The threshold or velocity window considered zero (SP42) is too small; thus, increase the value of this parameter.
The module is performing poorly and is unable to stop the motor. The module may be defective.

E.106

Extreme temperature at the heatsink (of the IGBT's)



- Cause.** The drive is carrying out a task that overheats the power devices.

- Solution.** Stop the system for several minutes and decrease the effort demanded from the drive.

E.108

Motor overheated



- Cause.** The motor has overheated. The motor temperature measuring cables (position sensor cable) or the temperature sensor itself are defective. The application may be demanding high current peaks.

- Solution.** Stop the system for several minutes and decrease the effort demanded from the motor. Cool the motor.

E.156

Following error



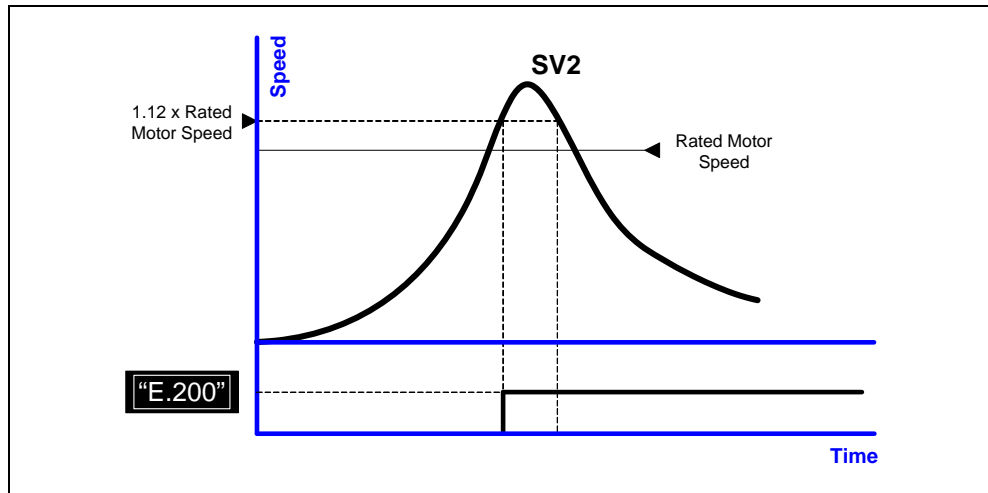
- Cause.** Too much following error has been generated.

E.200

Overspeed

E.200

Cause. The motor speed has exceeded the value of SP10 in a 12%.



Solution. Bad cabling or poor connection of the position sensor or of the motor power.

Maybe, the velocity loop is not adjusted properly. There may be a speed overshooting in the system response. Decrease the overshooting.

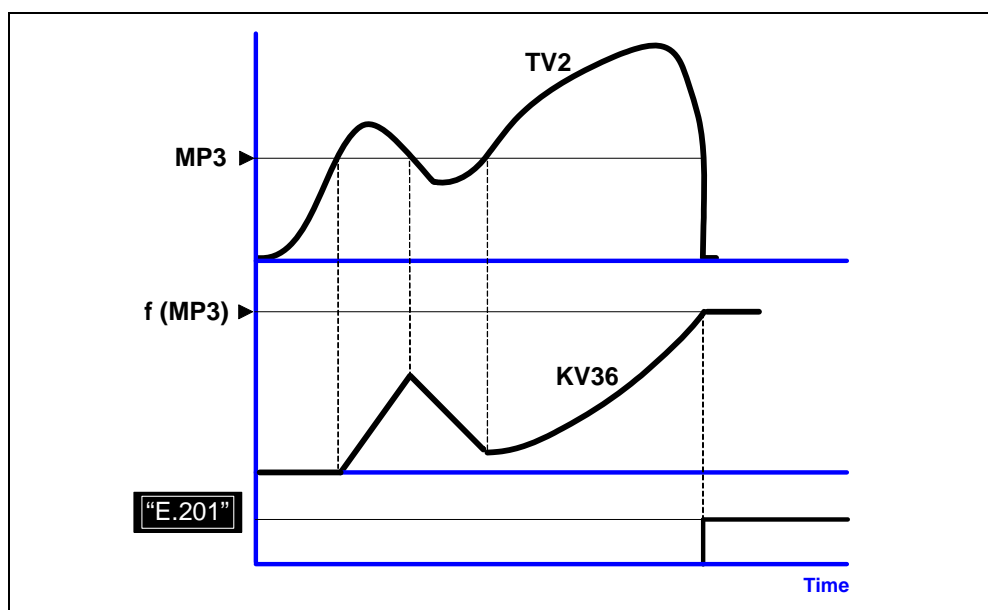
E.201

Motor overload

E.201

Cause. The duty cycle demanded from the motor is greater than it can provide causing the motor I^2t protection to go off.

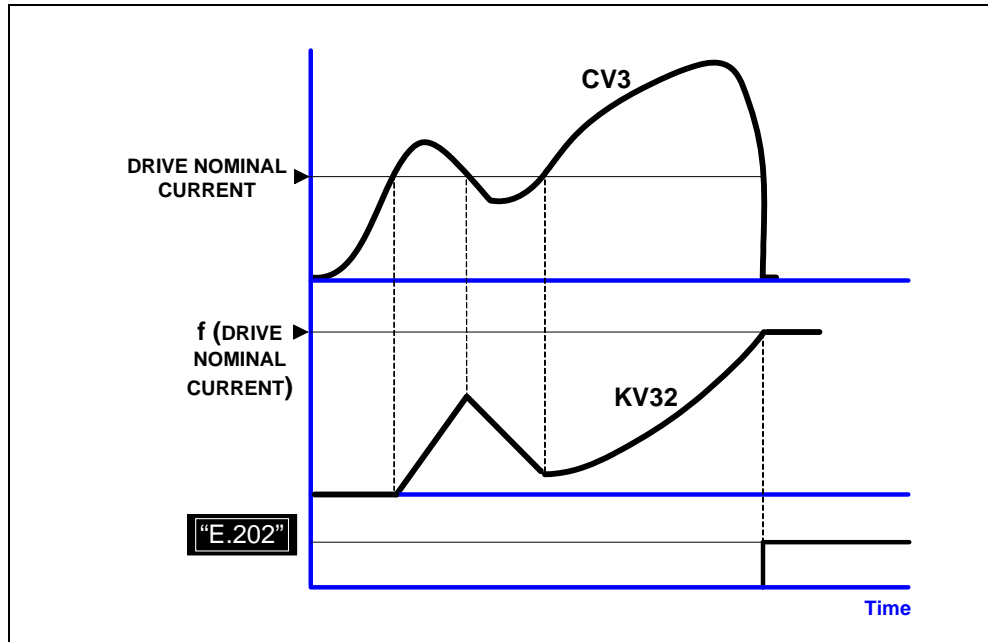
Solution. Change its duty cycle.



E.202**Drive overload****E.202**

Cause. The duty cycle demanded from the motor is greater than it can provide causing the drive I^2t protection to go off.

Solution. Change its duty cycle.

**E.214****Short-circuit****E.214**

Cause. A short-circuit has been detected at the drive module.

Solution. Perform an "error reset". If the error persists, it may be because:

- An erroneous sequence when connecting the power cables or several of them causing a short-circuit between them.
- Some wrong parameter or some failure at the drive.

If the error persists, contact Fagor Automation.

Observe that after displaying E.214, one of the codes of the following table will be displayed informing on which drive the alarm has been detected.

1L	The 1st one of the bottom
1H	The 1st one of the top
2L	The 1st one of the top
2H	The 2nd one of the top
3L	The 3rd one of the bottom
3H	The 3rd one of the top
CR	That of the Ballast

E.304 Power bus voltage of the drive too high

Causes. The hardware of the drive module has detected that the voltage at the power bus is too high.

Solution. Check the connection of the external Ballast resistor (if applicable) and make sure it is in good condition.
Disconnect the power supply and check the proper connection of the Ballast circuit.

E.307 Power bus voltage too low

Cause. The mains voltage is lower than the admitted minimum voltage.

Solution. Disconnect the power supply and check the proper condition of the lines.

E.314 Ballast circuit overload

Cause. Ballast resistor overload because the duty cycle forced on the circuit is too demanding.

Solution. Resize the ballast resistor for the required duty cycle or set a less demanding duty cycle.
Smooth the duty cycle by applying acceleration ramps.

E.420 Communication TimeOut between master and slave

Cause. Error generated in a DeviceNet communication. After establishing communication between the master and slave modules, a “timeout” error occurs; i.e. one of these two modules has exceeded the time limit set for resuming communication.

E.421 Error in the communication frame

Cause. Error generated in the frame in a DeviceNet communication usually caused by:

- Defective communication cable
- Low or now communication voltage
- Terminating resistor installed improperly.

E.502**Incompatible parameters****E.502****Cause.** Incompatible drive parameter setting.

Ej: A drive governs a 4000 rev/min motor with its parameters already adjusted (e.g. speed limit SP10=4400).

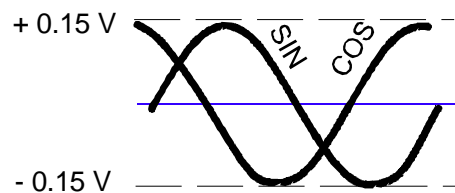
Now, another 2000 rev/min motor is connected to the same drive. The SP10 value set previously is higher than the one allowed for this new motor.

The drive notices this incompatibility and readjusts (in RAM memory) certain parameters and issues E.502. The QV22 variable indicates the parameters that are incompatible with each other so they can be set properly.

Observe that resetting the unit without saving the parameters causes the error to come up again. To avoid this, execute the GC1 command that permanently saves into E²PROM memory the parameters readjusted by the drive in RAM memory with their proper values.

E.506**Motor table missing****E.506****Solution.** Contact Fagor Automation.**E.510****Incoherent combination of motor and feedback****E.510****Cause.** The drive does not accept the motor that has been connected to it.

Motor's power voltage is different from that of the drive it is connected to. For example, connecting the motor FXM34.40A.E1.000, with A winding (400 V AC) to drive MCP-20L (220 V AC).

Solution. Check that the selected motor-drive combination is coherent.**E.605****Excessive damping of the analog signals of the motor feedback.****E.605****Cause.** One of the sine or cosine signals of the encoder has reached a peak level lower than 150 mV.**Solution.** Contact Fagor Automation.

E.801 Encoder not detected

Cause. The drive has not detected the rotor sensor.

Solution. Match the selected sensor with the feedback installed and, if the error persists, contact Fagor Automation.

E.802 Defective encoder

Cause. Communication error when using a SinCos™ or SinCoder™ encoder.
Incoherent U, V, W signals when using an incremental I/O encoder.

Solution. Contact Fagor Automation.

E.803 Encoder not initialized

Solution. Contact Fagor Automation.

WARNINGS

The warnings indicate that the drive is approaching an error limit.

Thus:

❑ Before the drive display shows errors E.201, E.202 and E.314, it will issue a warning with fast flashing (0.5 s) of the BUS ACTIVITY indicator. If this behavior continues for longer than 5 s, the display will show one of the errors mentioned earlier.

❑ **Warning W.003.** Warning due to a drive power-up failure. It will appear in the following circumstances. When a unit is powered up and:

- ❑ The connector of the Crowbar resistor has not been installed.
- ❑ The Crowbar resistor is open.
- ❑ Only two phases of the unit have been powered.
- ❑ A 380 V unit has been powered at 220 V.

❑ **Warning W.157.** Null or wrong starting block. This warning comes up when activating the START signal to execute a starting block while the switches are pointing to an empty block number. It applies to any block.

❑ **Warning W.911.** Absolute motion block to be executed without searching home or incremental motion block while the software limits are activated.

Warning. The block may be executed even if home search has not been carried out as long as the software limits are not activated.

❑ **Warning W.917.** "Software travel limit approaching" warning. This indication indicates that it is getting close to the that limit.

LIST OF PARAMETERS, VARIABLES & COMMANDS. ModBus IDs

Mnem.	Name	Level	IdBus	Ac	Min.	Max.	Def.	Units	Page
AP1	PrimaryOperationMode	Fagor	00065	rw	2	5	3	----	68
BV14	NotProgrammableIOs	Fagor	08601	ro	0	65535	----	----	68
CP1	CurrentProportionalGain	Fagor	00213	rw	0	999	----	----	68
CP2	CurrentIntegralTime	Fagor	00215	rw	0	999	----	----	69
CP10	VoltageAmpVolt	user	08823	rw	1000	9999	9500	mV	69
CP11	AmpAmpVolt	user	08825	rw	100	5000	5000	cA	69
CP20	CurrentLimit	basic	08807	rw	0	5000	0	cA	69
CP30	CurrentCommandFilter1Type	Fagor	08809	rw	0	1	0	----	69
CP31	CurrentCommandFilter1Frequency	Fagor	08817	rw	0	4000	0	Hz	70
CP32	CurrentCommandFilter1Damping	Fagor	08819	rw	0	1000	0	Hz	70
CP45	CurrentCommandSelector	user	08821	rw	0	3	0	----	70
CV1	Current1Feedback	user	08811	ro	- 5000	5000	----	cA	71
CV2	Current2Feedback	user	08813	ro	- 5000	5000	----	cA	71
CV3	CurrentFeedback	user	08815	ro	- 5000	5000	----	cA	71
CV10	Current1Offset	Fagor	08803	ro	- 2000	2000	----	mA	71
CV11	Current2Offset	Fagor	08805	ro	- 2000	2000	----	mA	72
CV15	DigitalCurrentCommand	user	08827	rw	- 5000	5000	0	cA	72
DC1	ResetClass1Diagnostics	user	00199	rw	0	15	0	----	74
DC2	ClearHistoricOfErrorsCommand	user	08997	rw	0	15	0	----	74
DV17	HistoricOfErrors	user	09012	ro	----	----	----	----	72
DV31	DriverStatusWord	Fagor	00271	ro	0	65535	----	----	72
DV32	MasterControlWord	Fagor	00269	rw	0	65535	0	----	73
DV50	ErrorBitArea	Fagor	24560	ro	----	----	----	----	73
DV51	WarningBitArea	Fagor	24571	ro	----	----	----	----	74
EP1	EncoderSimulatorPulsesPerTurn	basic	09193	rw	0	pulses	----	----	74
EP3	EncoderSimulatorDirection	basic	09197	rw	0	1	0	----	75
EP4	EncoderSimulatorHighFreqEnable	basic	09201	rw	0	1	0	pulses	75
GC1	BackupWorkingMemoryCommand	basic	00529	rw	0	15	0	----	77
GC10	LoadDefaultsCommand	basic	00525	rw	0	15	0	----	77
GP3	StoppingTimeout	basic	09597	rw	0	9999	500	ms	75
GP5	ParameterVersion	basic	09601	ro	----	----	----	----	75
GP9	DriveOffDelayTime	basic	00415	rw	0	9999	50	ms	75
GP11	IOFunctionsTime	user	09645	rw	0	9999	2000	ms	76
GP15	AutomaticInitialization	Fagor	09643	rw	0	1	1	----	76
GP16	MonoPhaseSelector	basic	09647	rw	0	1	0	----	76
GV2	ManufacturerVersion	basic	00060	ro	----	----	----	----	76
GV5	CodeChecksum	basic	09605	ro	----	----	----	----	76
GV7	Password	basic	00535	rw	0	9999	0	----	76
GV9	DriveType	basic	00280	ro	----	----	----	----	77
GV11	SoftReset	basic	09609	rw	0	16	0	----	77
GV16	MotorTableVersion	basic	09625	ro	----	----	----	----	77
GV75	ErrorList	Fagor	00750	ro	----	----	----	----	77
HV5	PLDVersion	basic	08783	ro	----	----	----	----	77
IP6	DigitalInputPolarity	user	10013	rw	0	1	0	----	78
IP14	DigitalInputFunctionSelector	user	10015	rw	0	4	4	----	78
IP17	AnalogFunctionSelector	user	10017	rw	0	2	0	----	78
IV1	AnalogInput1	basic	10003	ro	- 12000	12000	----	mV	79
IV2	AnalogInput2	user	10005	ro	- 1200	1200	----	cV	79
IV3	CurrentCommandAfterScaling	user	10019	ro	- 9999	9999	----	cA	79
IV10	DigitalInputs	user	10007	ro	0	1	----	----	79
IV11	DigitalInputsCh2	user	10009	ro	0	1	----	----	79
KP3	ExtBallastPower	user	10421	rw	200	2000	200	W	79
KP4	ExtBallastEnergyPulse	user	10425	rw	200	2000	200	J	80
KV6	MotorTemperature	basic	00767	ro	- 20	200	----	° C	80

Mnem.	Name	Level	IdBus	Ac	Min.	Max.	Def.	Units	Page
KV10	CoolingTemperature	user	10397	ro	- 20	200	-----	° C	80
KV32	I2tDrive	user	10410	ro	0	100	-----	%	80
KV36	I2tMotor	user	10415	ro	0	100	-----	%	80
KV40	I2tCrowbar	user	10423	ro	0	100	-----	%	80
KV41	BallastSelect	user	10427	rw	0	1	1	-----	80
LP22	JogVelocity	Fagor	12836	rw	0	500000	1000	mm/min	81
LP23	JogIncrementalPosition	Fagor	12838	rw	0	2 ³¹ -1	10000	dµm or m°	81
LP48	PositionActionsSelect	Fagor	12905	rw	0	1	0	-----	81
LP49	InbandPosition	Fagor	12906	rw	0	2 ³¹ -1	5000	dµm or m°	82
LP143	ModuloCommandMode	Fagor	00787	rw	0	2	2	-----	82
LV13	KernelOperationMode	Fagor	12819	rw	0	1	0	-----	83
LV14	KernelAutoMode	Fagor	12821	rw	0	1	0	-----	83
LV15	KernelStartSignal	Fagor	12823	rw	0	1	0	-----	83
LV16	KernelStopSignal	Fagor	12825	rw	0	1	0	-----	83
LV17	KernelResetSignal	Fagor	12827	rw	0	1	0	-----	83
LV19	KernelManMode	Fagor	12831	rw	0	1	0	-----	83
LV20	JogPositiveSignal	Fagor	12833	rw	0	1	0	-----	84
LV21	JogNegativeSignal	Fagor	12835	rw	0	1	0	-----	84
LV35	BlockTravelDistance	Fagor	12862	ro	-2 ³¹	2 ³¹ -1	0	dµm or m°	84
LV36	BlockCoveredDistance	Fagor	12864	ro	-2 ³¹	2 ³¹ -1	0	dµm or m°	84
LV158	TargetPosition	Fagor	00516	ro	-2 ³¹	2 ³¹ -1	0	dµm or m°	84
LV159	PositioningVelocity	Fagor	00518	ro	-2 ³¹	2 ³¹ -1	0	mm/min	84
LV160	PositioningAcceleration	Fagor	00520	rw	0	2 ³¹ -1	5000	mm/s ² or rad/s ²	84
LV161	PositioningAcceleration2	Fagor	00522	rw	0	2 ³¹ -1	5000	mm/s ² or rad/s ²	85
LV242	TargetPositionAttained	Fagor	00685	ro	0	1	-----	-----	85
MP1	MotorType	basic	00282	rw	-----	-----	-----	-----	85
MP2	MotorTorqueConstant	Fagor	10593	rw	0	100	-----	dNm/A	85
MP3	MotorContinuousStallCurrent	Fagor	00223	rw	0	5000	-----	cA	85
NP117	ResolutionOfFeedback2	Fagor	00235	rw	0	65535	4096	ppv	86
NP118	ResolutionOfLinearFeedback	Fagor	00237	rw	0	65535	200	dµm	86
NP121	InputRevolutions	Fagor	00243	rw	1	65535	1	turns	86
NP122	OutputRevolutions	Fagor	00245	rw	1	65535	1	turns	86
NP123	FeedConstant	Fagor	00246	rw	0	2 ³¹ -1	50000	dµm or m°	86
NP131	InputRevolutions2	Fagor	08453	rw	1	65535	1	turns	87
NP132	OutputRevolutions2	Fagor	08455	rw	1	65535	1	turns	87
NP133	FeedConstant2	Fagor	08456	rw	0	2 ³¹ -1	50000	dµm or m°	87
OP1	DA1IDN	user	10993	rw	0	13	4	-----	89
OP2	DA2IDN	user	10995	rw	0	13	7	-----	89
OP3	DA1ValuePer10Volt	user	10997	rw	0	9999	4000	-----	89
OP4	DA2ValuePer10Volt	user	10999	rw	0	9999	3000	-----	89
OP6	DigitalOutputPolarity	user	11025	rw	0	1	0	-----	90
OP14	DigitalOutputFunctionSelector	user	11021	rw	0	7	0	-----	90
OP15	DigitalOutputWarningSelector	user	11023	rw	0	2	0	-----	90
OV10	DigitalOutputs	user	11013	ro	0	1	0	-----	91
OV11	DigitalOutputsCh2	user	11019	rw	0	1	0	-----	91
PC148	DriveControlledHoming	Fagor	00297	ro	0	15	0	-----	98
PC150	ChangePosFB12	basic	10799	rw	0	15	0	-----	98
PP1	HomingVelocitySlow	Fagor	00081	rw	0	1200	100	rpm	92
PP41	HomingVelocityFast	Fagor	00083	rw	0	6000	200	rpm	92
PP42	HomingAcceleration	Fagor	00084	rw	0	2 ³¹ -1	5000	mm/s ²	92
PP49	PositivePositionLimit	Fagor	00098	rw	- 2 ³¹	2 ³¹ -1	2 ³¹ -1	dµm	92
PP50	NegativePositionLimit	Fagor	00100	rw	- 2 ³¹	2 ³¹ -1	2 ³¹ -1	dµm	92
PP52	ReferenceDistance1	Fagor	00104	rw	- 2 ³¹	2 ³¹ -1	0	dµm or m°	93
PP54	ReferenceDistance2	Fagor	00108	rw	- 2 ³¹	2 ³¹ -1	0	dµm or m°	93
PP55	PositionPolarityParameters	Fagor	00111	rw	0	65535	17	-----	93
PP57	PositionWindow	Fagor	00114	ro	- 2 ³¹	2 ³¹ -1	20000	dµm or m°	94
PP76	PositionDataScalingType	Fagor	00153	rw	1	65535	1	-----	94
PP103	Value module	Fagor	00206	rw	0	2 ³¹ -1	360	degrees	94
PP104	PositionKvGain	Fagor	00209	rw	0	65535	10	-----	94
PP105	PositionKvGain2	Fagor	00211	rw	0	65535	10	-----	95

Mnem.	Name	Level	IdBus	Ac	Min.	Max.	Def.	Units	Page
PP115	PositionFeedback2Type	Fagor	00231	rw	0	32	0	-----	95
PP147	HomingParameter	Fagor	00295	rw	0	65535	0	-----	95
PP159	MonitoringWindow	Fagor	00318	rw	0	2 ³¹ -1	30000	dµm or m°	96
PP216	VelocityFeedForwardPercentage	Fagor	00593	rw	0	120	0	%	96
PP218	VelocityFeedForwardPercentage2	Fagor	10829	rw	0	120	0	%	96
PV47	PositionCommand	Fagor	00094	ro	- 2 ³¹	2 ³¹ -1	-----	dµm or m°	97
PV51	PositionFeedback1	Fagor	00102	ro	- 2 ³¹	2 ³¹ -1	-----	dµm or m°	97
PV53	PositionFeedback2	Fagor	00106	ro	- 2 ³¹	2 ³¹ -1	-----	dµm or m°	97
PV173	MarkerPositionA	user	00346	ro	- 2 ³¹	2 ³¹ -1	-----	-----	97
PV189	FollowingError	Fagor	00378	ro	- 2 ³¹	2 ³¹ -1	-----	dµm or m°	97
PV200	HomeSwitch	Fagor	00801	ro	0	1	0	-----	97
PV208	ReferenceMarkerPulseRegistered	Fagor	00817	ro	0	1	-----	-----	97
QP14	ProtocolTypeSelector	user	12213	rw	2	5	2	-----	99
QP16	SerialSettings	user	12217	rw	0	65535	1540	-----	99
QV22	IDNListOfInvalidOperationData	Fagor	00044	ro	-----	-----	-----	-----	100
QV96	SlaveArrangement	user	00193	rw	0	127	1	-----	100
RC1	EncoderParameterStoreCommand	Fagor	11219	rw	0	15	0	-----	101
RP1	FeedbackSineGain	Fagor	11193	rw	0	8192	4096	-----	101
RP2	FeedbackCosineGain	Fagor	11195	rw	0	8192	4096	-----	101
RP3	FeedbackSineOffset	Fagor	11197	rw	- 2000	2000	0	-----	101
RP4	FeedbackCosineOffset	Fagor	11199	rw	- 2000	2000	0	-----	101
RV1	FeedbackSine	user	11205	ro	- 512	511	-----	-----	101
RV2	FeedbackCosine	user	11207	ro	- 512	511	-----	-----	101
RV3	FeedbackRhoCorrection	Fagor	11209	ro	0	65535	-----	-----	101
SP1	VelocityProportionalGain	basic	00201	rw	0	9999	-----	dmArms/rpm	102
SP2	VelocityIntegralTime	basic	00203	rw	0	9999	-----	dms	102
SP3	VelocityDerivativeGain	basic	00205	rw	0	9999	0	-----	102
SP10	VelocityLimit	basic	00183	rw	0	9999	1000	rpm	102
SP19	SymmetryCorrection	basic	11431	rw	- 500	500	0	mV	102
SP20	VoltageRpmVolt	basic	11433	rw	1000	9999	9500	mV	103
SP21	RpmRpmVolt	basic	11435	rw	10	9999	4000	rpm	103
SP30	VelocityOffset	basic	11399	rw	- 2000	2000	0	crpm	103
SP40	VelocityThresholdNx	user	00251	rw	0	9999	1000	rpm	103
SP41	VelocityWindow	user	00315	rw	0	9999	20	rpm	104
SP42	StandStillWindow	user	00249	rw	0	9999	20	rpm	104
SP43	VelocityPolarityParameters	basic	00087	rw	0	1	0	-----	104
SP45	VelocityCommandSelector	basic	11427	rw	0	2	0	-----	104
SP60	AccelerationLimit	basic	00277	rw	0	4000	0	(drpm)/ms	105
SP65	EmergencyAcceleration	basic	11411	rw	0	4000	0	(drpm)/ms	105
SP66	VelocityDecelerationTime	basic	11429	rw	0	4000	0	(drpm)/ms	106
SV1	VelocityCommand	basic	00072	rw	-6E7	6E7	0	dmrpm	106
SV2	VelocityFeedback	basic	00080	ro	-6E7	6E7	-----	dmrpm	106
SV6	VelocityCommandAfterFilters	basic	11436	ro	-6E7	6E7	-----	dmrpm	106
SV7	VelocityCommandFinal	basic	11416	ro	-6E7	6E7	-----	dmrpm	106
SV15	DigitalVelocityCommand	user	11438	rw	-6E7	6E7	0	dmrpm	106
TP1	TorqueThresholdTx	user	00253	rw	0	100	5	%	107
TV1	TorqueCommand	user	00161	ro	- 9999	9999	0	dNm	107
TV2	TorqueFeedback	user	00169	ro	- 9999	9999	-----	dNm	107

DEDICATED PLC REGISTERS

Mnem.	Name	Level	IdBus	Ac	Min.	Max.	Def.	Units	Page
RG1	PiecesCount	user	16387	rw	0	65535	0	-----	108
RG2	ActualPiecesCount	user	16389	rw	0	65535	0	-----	108
RG3	RunningBlock	user	16391	rw	1	127	0	-----	108
RG4	PositionBlockIni	user	16393	rw	1	127	0	-----	108

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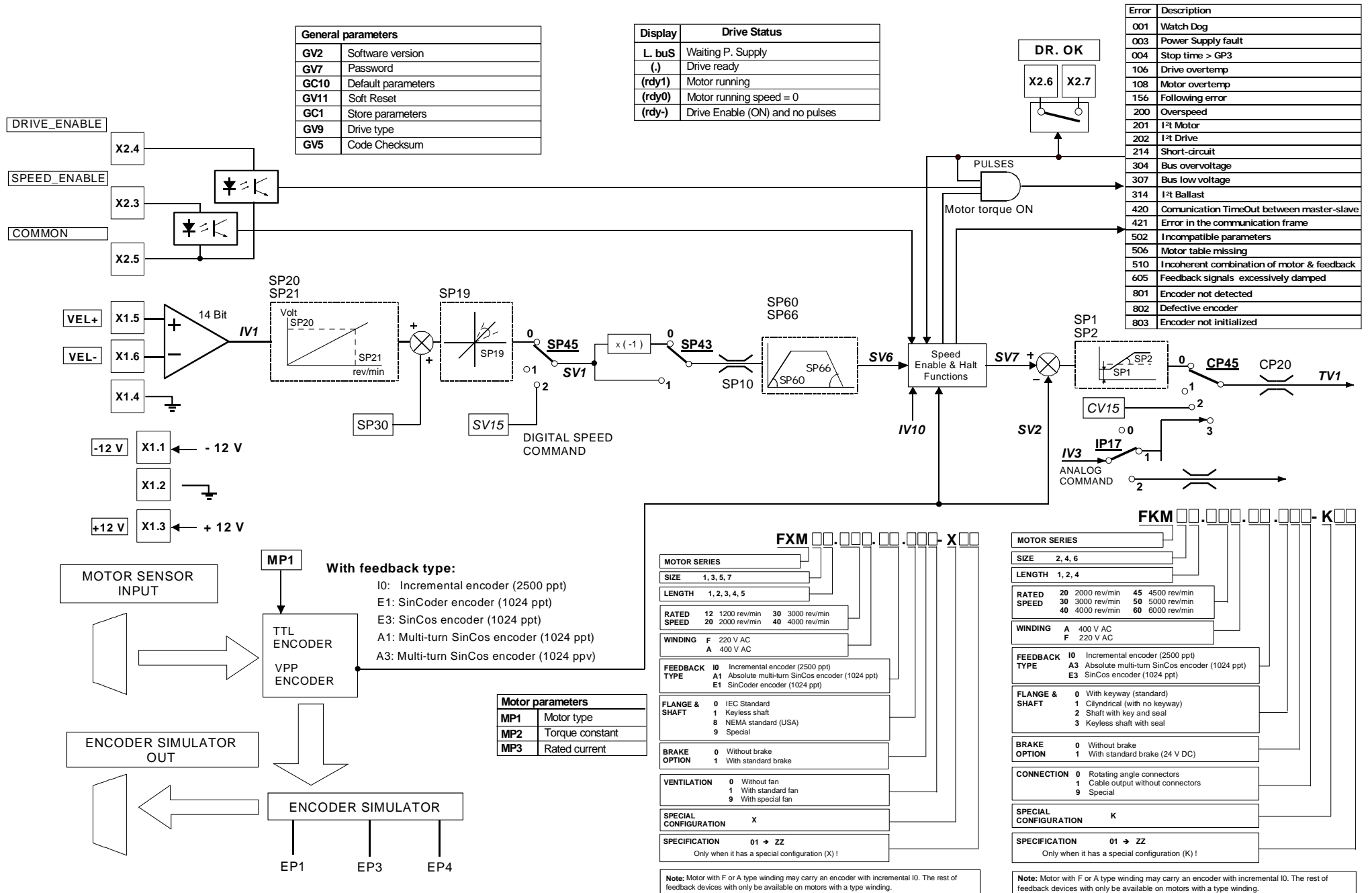
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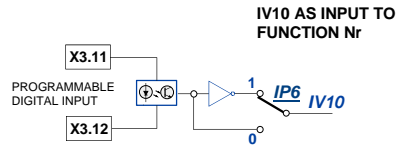
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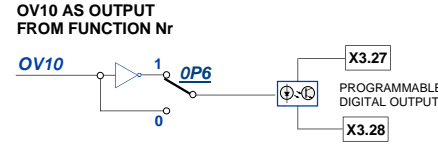
VELOCITY CONTROL BLOCK DIAGRAM



I/O FUNCTIONS

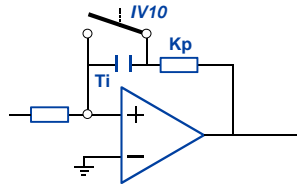


IP14	FUNCTION
00	INFUNC0
01	INFUNC1
02	INFUNC2
03	INFUNC3

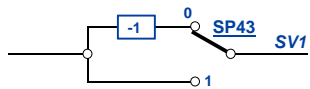


FUNCTION	OP14
OUTFUNC0	00
OUTFUNC1	01
OUTFUNC2	02
OUTFUNC3	03
OUTFUNC4	04
OUTFUNC5	05
OUTFUNC6	06
OUTFUNC7	07

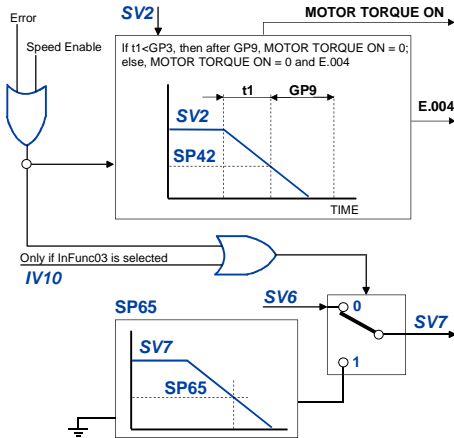
IP14 01 REMOTE P. / P.I. CONTROL



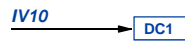
IP14 02 SERVO MOTOR ROTATION DIRECTION



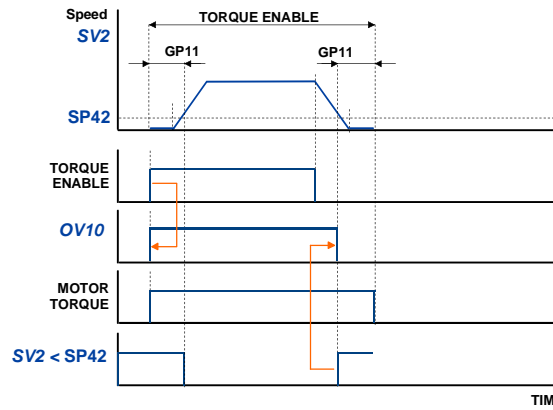
IP14 03 HALT



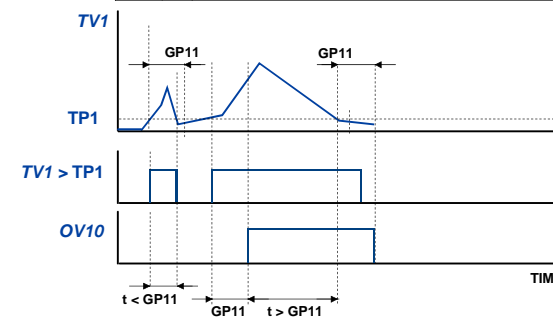
IP14 04 ERROR RESET



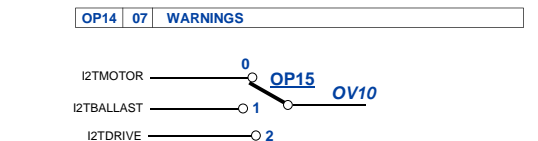
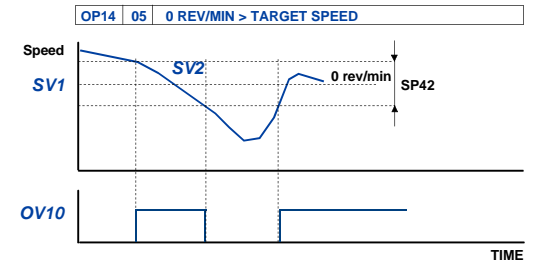
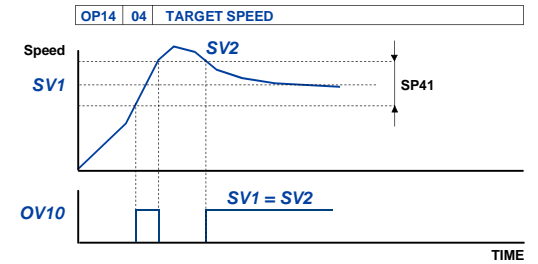
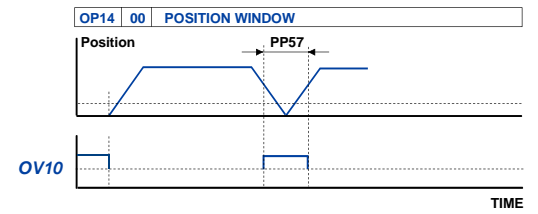
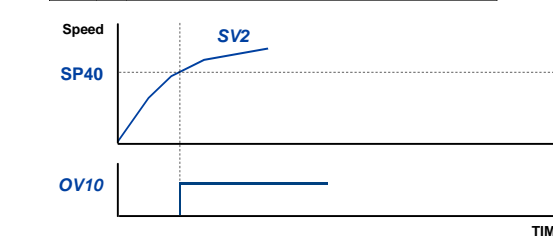
OP14 01 MOTOR BRAKE CONTROL



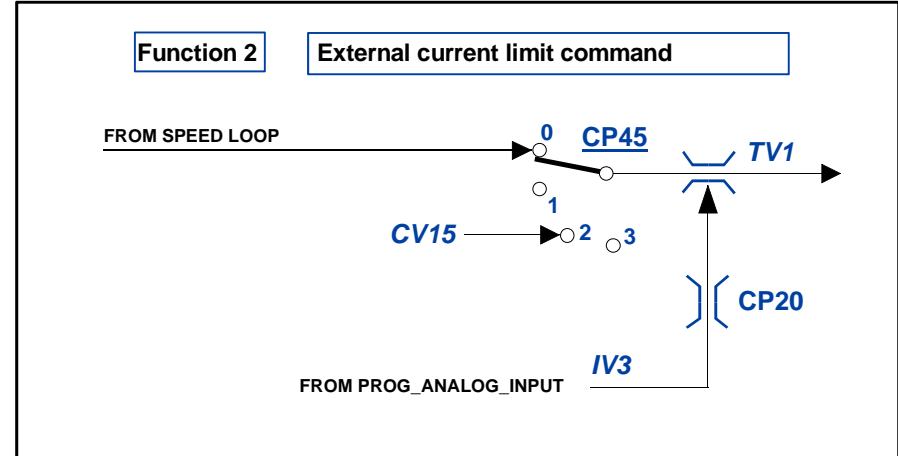
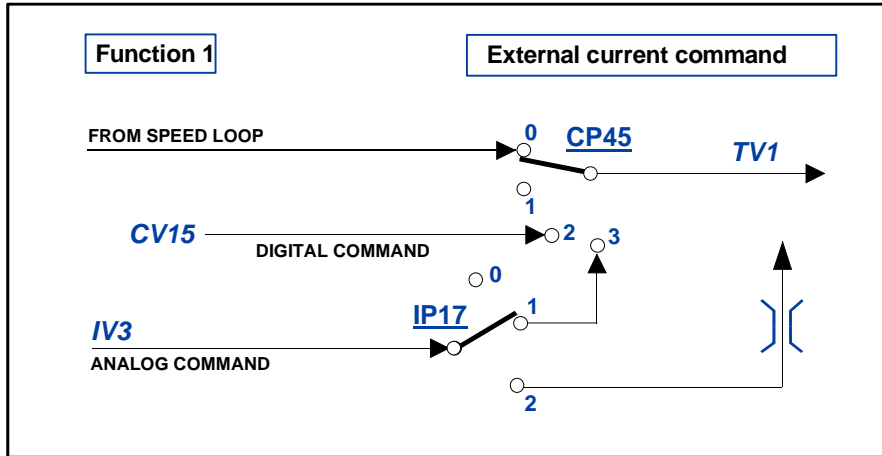
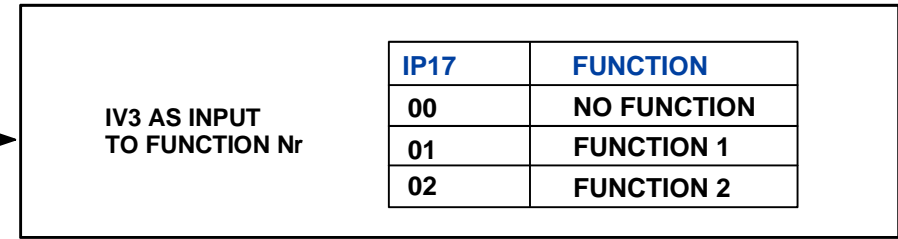
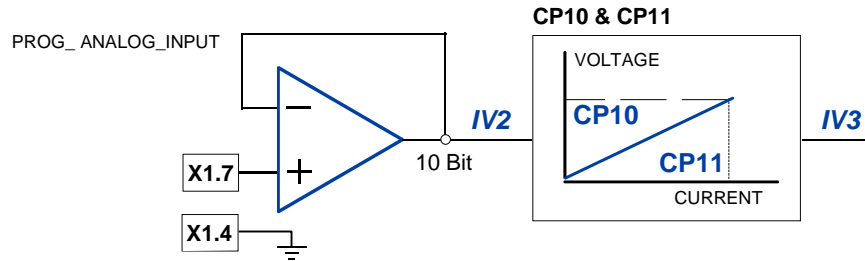
OP14 02 TORQUE LIMIT



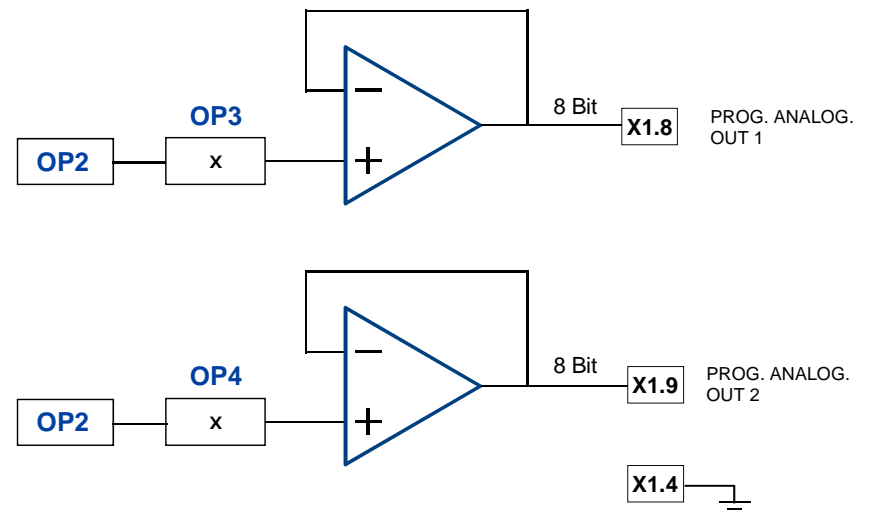
OP14 03 MOTOR SPEED > SP40



ANALOG FUNCTIONS

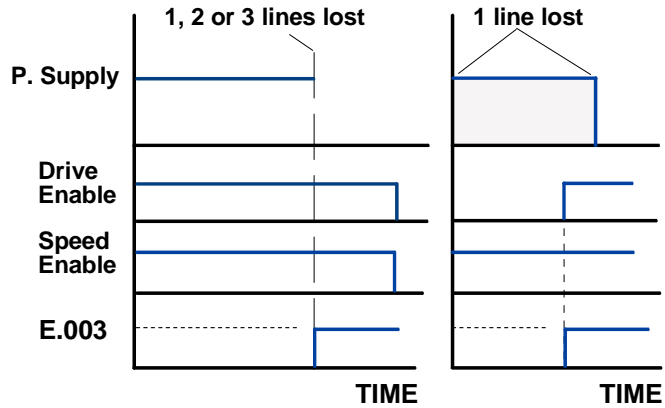


OP1	VARIABLE	OP2	VARIABLE	UNITS
00	SV15	00	SV15	rev/min
01	SV1	01	SV1	rev/min
02	SV6	02	SV6	rev/min
03	SV7	03	SV7	rev/min
04	SV2	04	SV2	rev/min
05	TV1	05	TV1	dNm
06	TV2	06	TV2	dNm
07	CV3	07	CV3	cA
09	IV1	09	IV1	mV
10	IV2	10	IV2	mV
11	RV1	11	RV1	bits
12	RV2	12	RV2	bits
13	PV189	13	PV189	µm

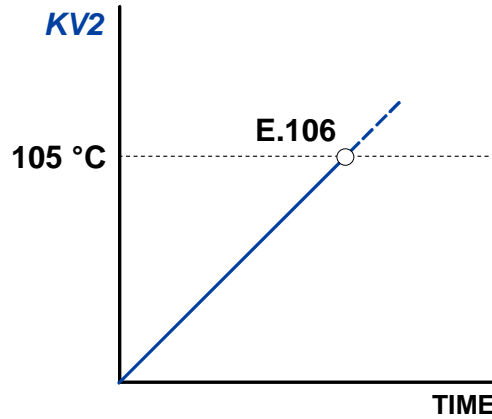


ERROR FUNCTIONS

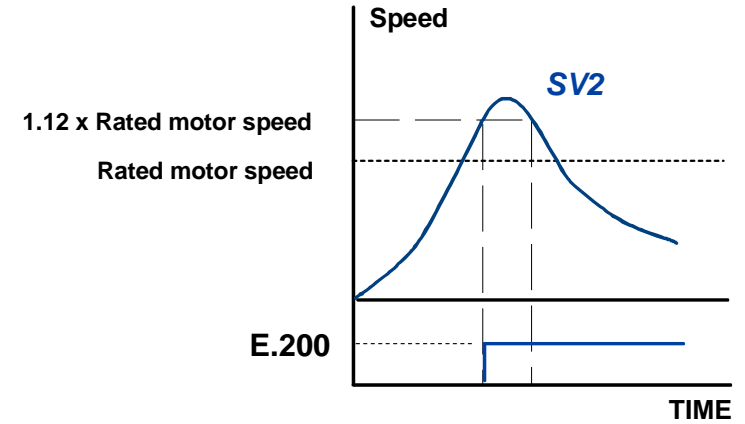
Function E.003 Power Supply fault



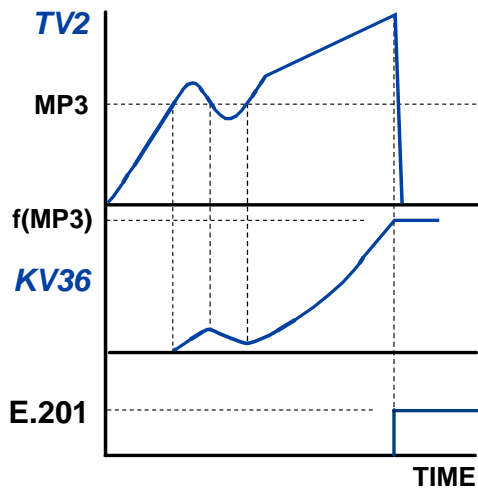
Function E.106 Drive overtemp



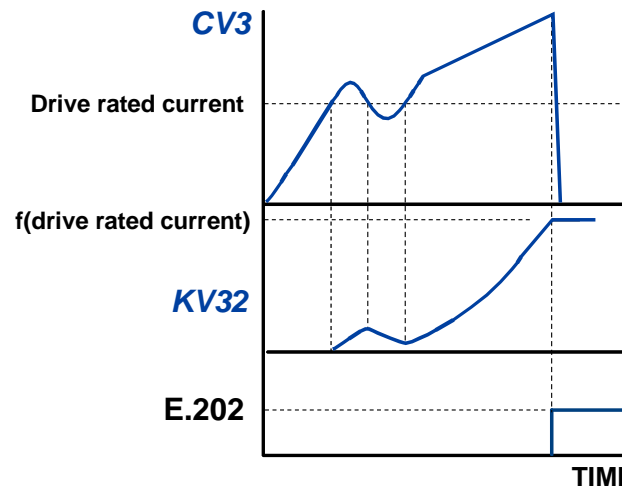
Function E.200 Overspeed



Function E.201 Motor overload

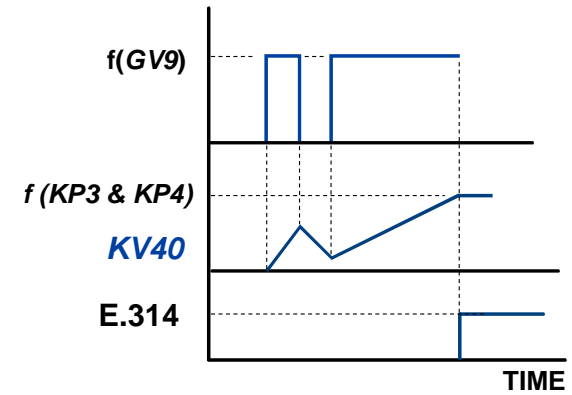


Function E.202 Drive overload



Function E.314 Ballast overload

KV41	1	Internal Ballast resistor
KV41	0	External Ballast resistor



INTERNAL STRUCTURE OF THE POSITIONING TABLE

POS MODE			POS VAL		VELPOS		EVENT & TIME			PROGOUT		LOOP & NEXT			****				
							EVENT TYPE		TIME			LOOP	NEXT		****	****	****	****	
	HWWORD	LWORD	HWWORD	LWORD	HWWORD	LWORD	HWWORD		LWORD	HWWORD	LWORD	HWWORD	LWORD		HWWORD	LWORD	HWWORD	LWORD	
								HBYTE	LBYTE				HBYTE	LBYTE					
ABSOLUTE		0001h	FROM 00000000h TO FFFFFFFFh		FROM 00000000h TO FFFFFFFFh		NONE	00h		RESERVED	FROM 0000h TO 00FFh	FROM 0000h TO FFFFh	FFh		END	RESERVED	RESERVED	RESERVED	RESERVED
INCREMENTAL		0002h					INRPOS	01h											
+ INFINITE		0003h					INTPOS	02h											
- INFINITE	0000h	0004h					INBAND	03h											
STOP		0005h					ACTSPEED	04h											
			NEXTSPEED	05h															



BLOCK NR	ADDRESS	DWORD1		DWORD2		DWORD3		DWORD4		DWORD5		DWORD6		DWORD7		DWORD8	
		HWWORD	LWORD	HWWORD	LWORD	HWWORD	LWORD	HWWORD	LWORD	HWWORD	LWORD	HWWORD	LWORD	HWWORD	LWORD	HWWORD	LWORD
1	6010h	6010h	6011h	6012h	6013h	6014h	6015h	6016h	6017h	6018h	6019h	601Ah	601Bh	601Ch	601Dh	601Eh	601Fh
2	6020h	6020h	6021h	6022h	6023h	6024h	6025h	6026h	6027h	6028h	6029h	602Ah	602Bh	602Ch	602Dh	602Eh	602Fh
3	6030h	6030h	6031h	6032h	6033h	6034h	6035h	6036h	6037h	6038h	6039h	603Ah	603Bh	603Ch	603Dh	603Eh	603Fh
...
...
...
128	6800h	6810h	6811h	6812h	6813h	6814h	6815h	6816h	6817h	6818h	6819h	681Ah	681Bh	681Ch	681Dh	681Eh	681Fh

ADDRESSING TABLE REGISTERS FROM MODBUS

FULL BLOCK ADDRESSING

DIR = 24576 + (16·Block Nr) → Decimal
 DIR = 6010h + (10h·Block Nr h) → Hexadecimal