FAGOR AUTOMATION S.COOP.

Brushless AC servo drives

~ MCP Innova series ~

Ref.0910

FAGOR

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Type of documentation	Description, installation and startup of small motors and digital positioning drives.
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October 2009 / Ref.0910

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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:

MCPi- 07L, MCPi-11L, MCPi-15L

and axis feed servo motors:

FSA01, FSA02, FSA04, FSA08, FSP01, FSP02, FSP04, FSP08

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

Electromagnetic Compatibility

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

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 a range of servo systems (AC brushless motor FS plus digital drive) for application between 0.318 and 2.39 N·m at a rated speed of 3000 rev/min.

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.

General index

BRUSHLESS AC MOTORS, FS

Introduction

FS synchronous servo motors (FSA and FSP series) 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.

General characteristics

Excitation	Permanent magnets
Temperature sensor	Not available
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	Eccentricity: 0.02 Concentricity: 0.04 Perpendicularity: 0.04
Roller bearings' life	20000 hours
Vibration resistance	Vibration acceleration: 49 m/s^2
Vibration class	15 µm or lower
Electrical insulation	Class B (130°C / 266°F)
Insulation resistance	500 V DC, 10 MΩ or greater
Dielectric rigidity	200 V motors: 1500 V AC, one minute
Body or housing	Totally enclosed and self-ventilated
Protection degree	General: standard IP 55 (shaft section excluded)
Storage temperature	From -20°C to 60°C (from -4°F to 140°F)
Ambient temperature allowed	From 0°C to 40°C (from 32°F to 104°F)
Working ambient humidity	From 20% to 80% (non condensing)
Voltage supply for the brake	24 V DC - the brake is optional -
Feedback	Standard: Incremental encoder (13 bits: 2028 ppt) Optional: Absolute encoder (16 bits: 16384 ppt)

FSA SERIES	Stall torque	Stall peak torque	Rated speed	Maximum speed	Stall current	Peak current	Rated power	Torque constant	Acceleration time	Inertia (*)	Mass (* *)	Peak torque (for 3s) MCPi		
	Mo	Mp	nN	nmax	Io	Ip	P	KT	tac	J	P	**07 L**	**11 L**	**15 L**
	Nm	Nm	rev/min	rev/min	Arms	Arms	W	Nm/Arms	ms	kg·cm^2	kg	Nm	Nm	Nm
FSA01.50F.□□.□□□	0.318	0.95	3000	5000	0.9	2.8	100	0.378	1.19	0.036	0.5	**0.95**		
FSA02.50F.□□.□□□	0.637	1.91	3000	5000	2.1	6.5	200	0.327	1.74	0.106	1.1	**1.91**		
FSA04.50F.□□.□□□	1.27	3.82	3000	5000	2.8	8.5	400	0.498	1.42	0.173	1.7	3.24	**3.82**	
FSA08.50F.□□.□□□	2.39	7.16	3000	5000	4.4	13.4	750	0.590	2.95	0.672	3.4	3.84	6.19	**7.16**

FSP SERIES	Stall torque	Stall peak torque	Rated speed	Maximum speed	Stall current	Peak current	Rated power	Torque constant	Acceleration time	Inertia (*)	Mass (* *)	Peak torque (for 3s) MCPi		
	Mo	Mp	nN	nmax	Io	Ip	P	KT	tac	J	P	**07 L**	**11 L**	**15 L**
	Nm	Nm	rev/min	rev/min	Arms	Arms	W	Nm/Arms	ms	kg·cm^2	kg	Nm	Nm	Nm
FSP01.50F.□□.□□□	0.318	0.95	3000	5000	0.9	2.8	100	0.392	1.62	0.049	0.7	**0.95**		
FSP02.50F.□□.□□□	0.637	1.91	3000	5000	2.0	6.0	200	0.349	3.17	0.193	1.4	**1.91**		
FSP04.50F.□□.□□□	1.27	3.82	3000	5000	2.6	8.0	400	0.535	2.72	0.331	2.1	3.48	**3.82**	
FSP08.50F.□□.□□□	2.39	7.16	3000	5000	4.1	13.9	750	0.641	9.21	2.10	4.2	4.17	6.73	**7.16**

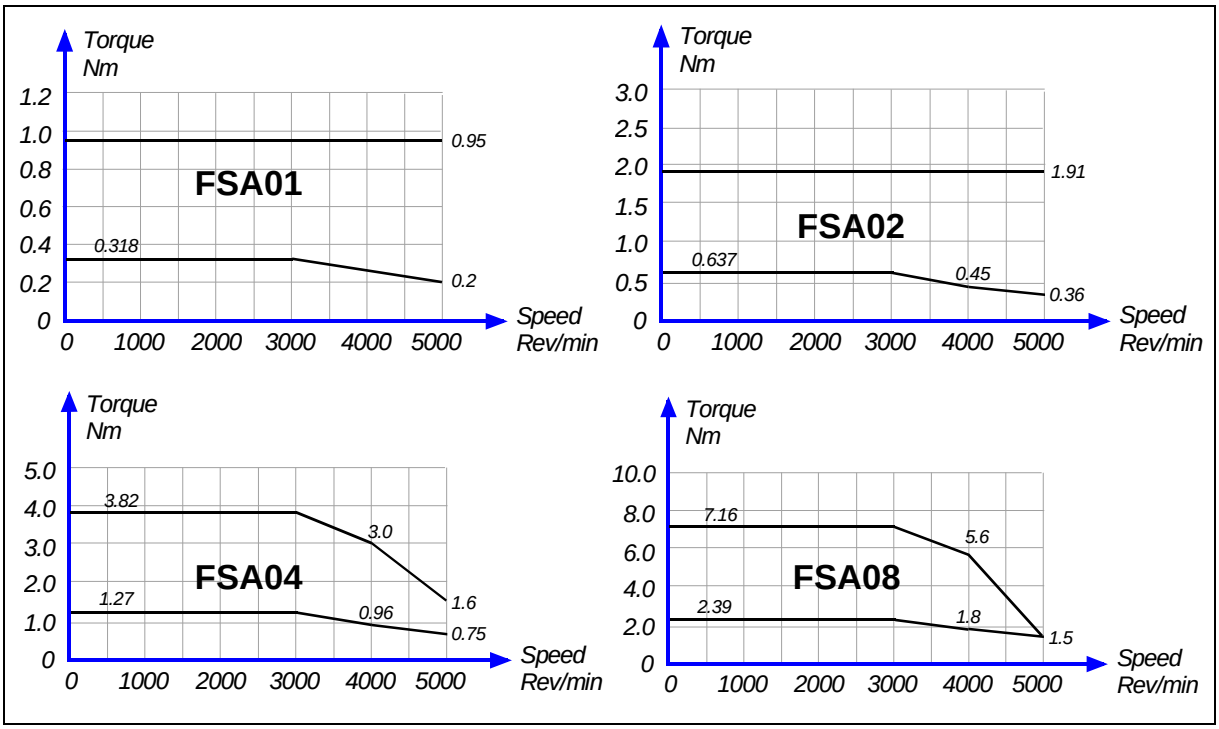
(*) If the motor has a brake (option), its inertia must also be taken into account. See section < Brake characteristics>.

(* *) If the motor has a brake (option), its mass must also be taken into account. See section < Brake characteristics>.

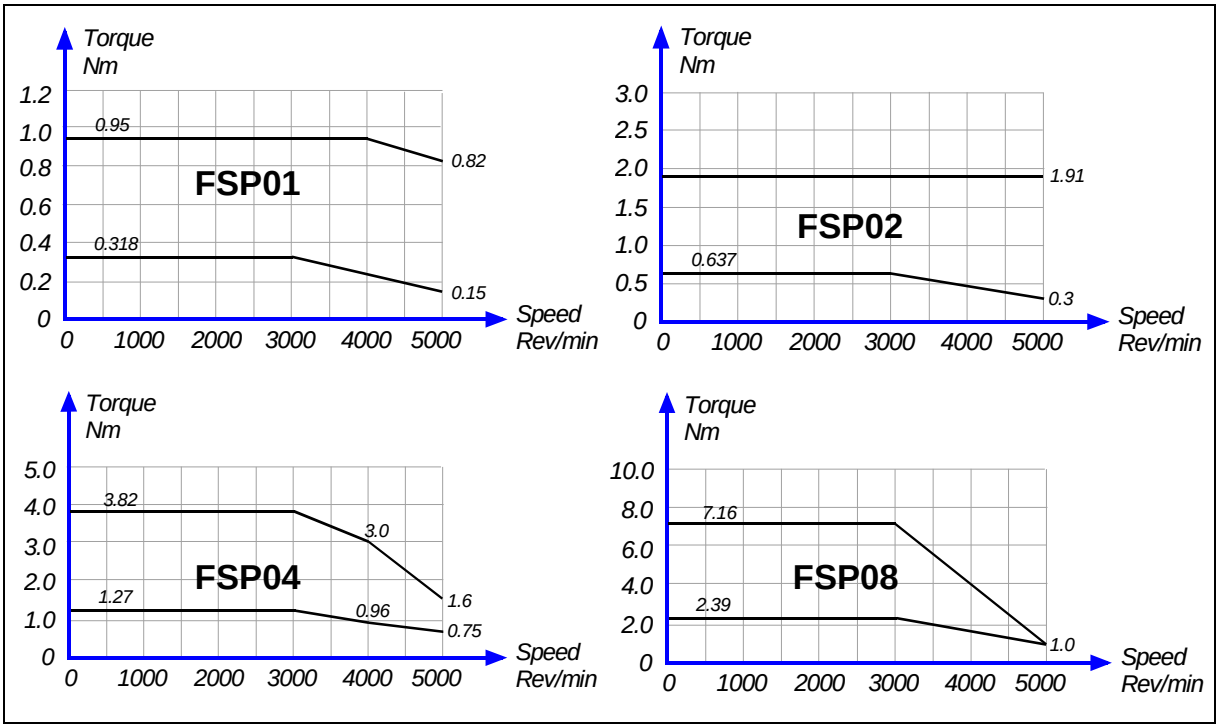
The drive recommended to govern each motor must supply the rated current needed to obtain the rated torque from the motor.

Torque-speed curves

Synchronous AC servomotors FSA series

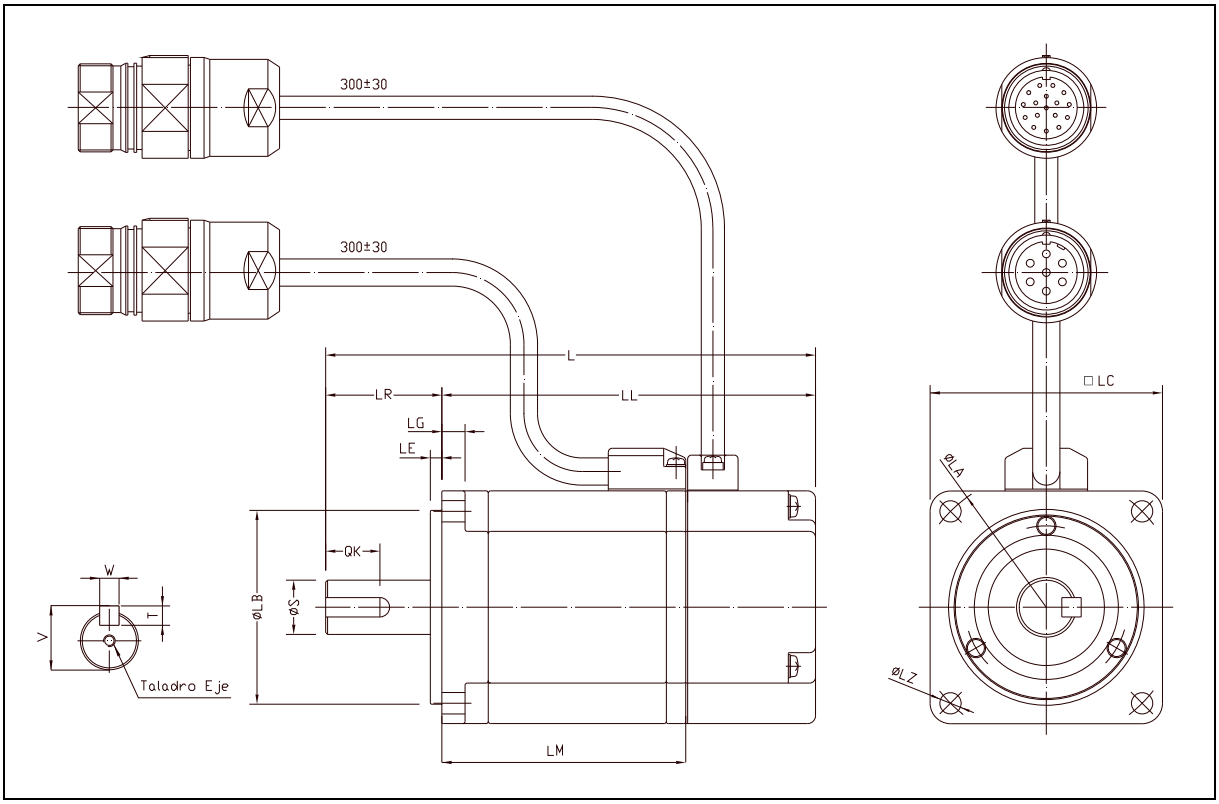


Synchronous AC servomotors. FSP series



Dimensions

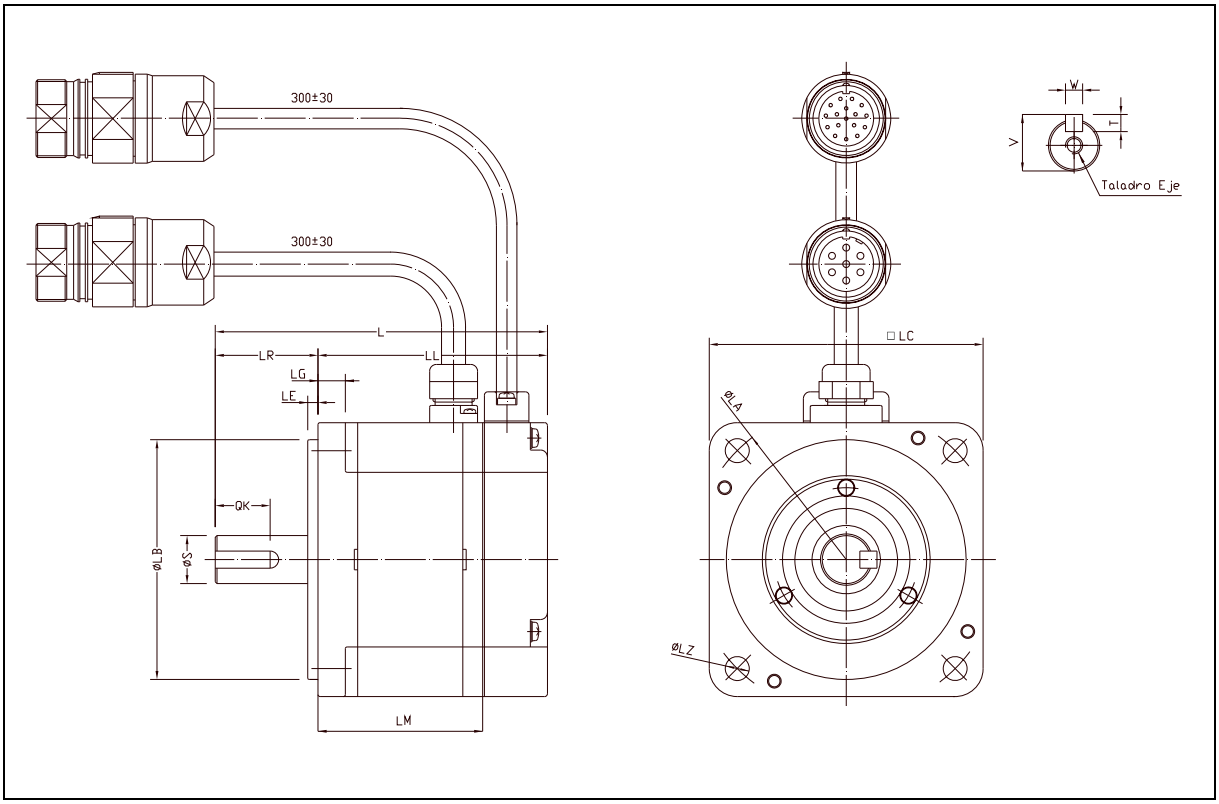
Synchronous AC servomotors FSA series



Dimensions	Motor length					Flange surface					
Motor type	**LM**	**L**	**LL**	**Δ brake**	**LR**	**LA**	**LB**	**LC**	**LE**	**LG**	**LZ**
FSA01	61.5	119.5	94.5	40.5	25	46	30h7	40	2.5	5	4.3
FSA02	63.0	126.5	96.5	39.5	30	70	50h7	60	3	6	5.5
FSA04	91.0	154.5	124.5	39.5	30	70	50h7	60	3	6	5.5
FSA08	111.5	185.0	145.0	44.5	40	90	70h7	80	3	8	7.0

The (Δ brake) column shows the length increment for the L and LL measurements when using a motor configuration “with brake”**.**

Dimensions	Shaft end					Shaft hole
Motor type	**S**	**QK**	**W**	**T**	**V**	
FSA01	8h6	14	3	3	9.2	M3 x 6
FSA02	14h6	20	5	5	16	M5 x 8
FSA04	14h6	20	5	5	16	M5 x 8
FSA08	16h6	30	5	5	18	M5 x 8



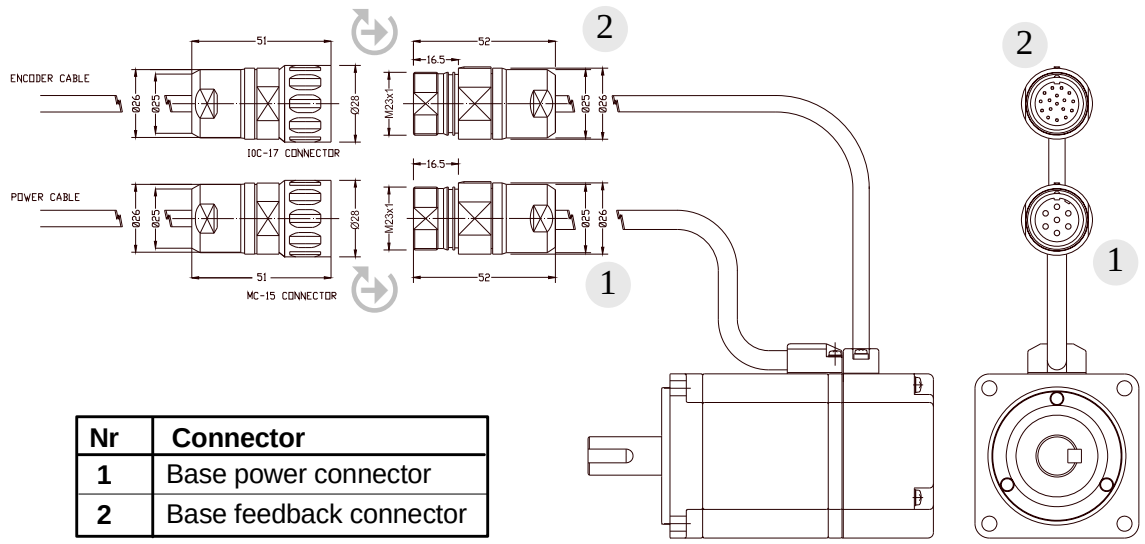
Dimensions	Motor length					Flange surface					
Motor type	**LM**	**L**	**LL**	**Δ brake**	**LR**	**LA**	**LB**	**LC**	**LE**	**LG**	**LZ**
FSP01	42.5	87	62	29.0	25	70	50h7	60	3	6	5.5
FSP02	48.1	97	67	31.5	30	90	70h7	80	3	8	7
FSP04	68.1	117	87	31.5	30	90	70h7	80	3	8	7
FSP08	66.7	126.5	86.5	33.5	40	145	110h7	120	3.5	10	10

The (Δ brake) column shows the length increment for the L and LL measurements when using a motor configuration “with brake”**.**

Dimensions	Shaft end					Shaft hole
Motor type	**S**	**QK**	**W**	**T**	**V**	
FSP01	8h6	14	3	3	9.2	M3 x 6
FSP02	14h6	16	5	5	16	M5 x 8
FSP04	14h6	16	5	5	16	M5 x 8
FSP08	16h6	22	5	5	18	M5 x 8

Base power connectors and encoder output

The following figure shows the identification of these connectors:



Nr	Connector
1	Base power connector
2	Base feedback connector

Note that although the figure shows the FSA series motor, the dimensions of all the connectors will be the same for the FSP series.

The base power connector includes pins 4 and 5 of the brake. Remember that it has no polarity and, therefore, the 24 V DC may be applied to either pin. 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) of the figure below, the shaft will turn clockwise (CWR, clockwise rotation).

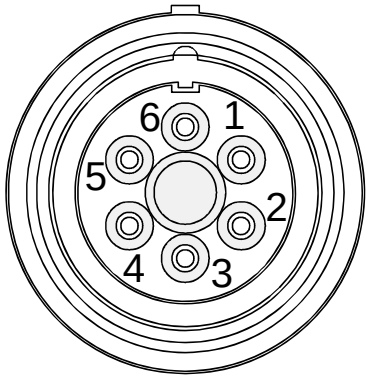
BASE POWER CONNECTOR

On FSA and FSP motors (200 V)

Pin	Signal	Color
1	U phase	Red
2	W phase	White
3	V phase	Blue
4	brake *	Black
5	brake *	Black
6	Ground	Green / Yellow

* No polarity

Viewed from the outside of the motor



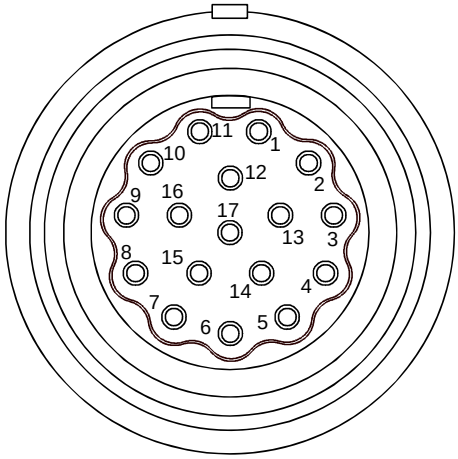
BASE FEEDBACK CONNECTOR

On FSA and FSP motors (200 V)

Pin	Signal	Color
1	0 V (16 bit absolute)	Pink
2	3.6 V (16 bit absolute)	Grey
3	+ RS485	Green
4	- RS485	Yellow
8	+ 5 V	White
9	0 V	Brown

Note 1. The rest of pins are not connected
Note 2. Connector housing connected to ground

Viewed from the outside of the motor



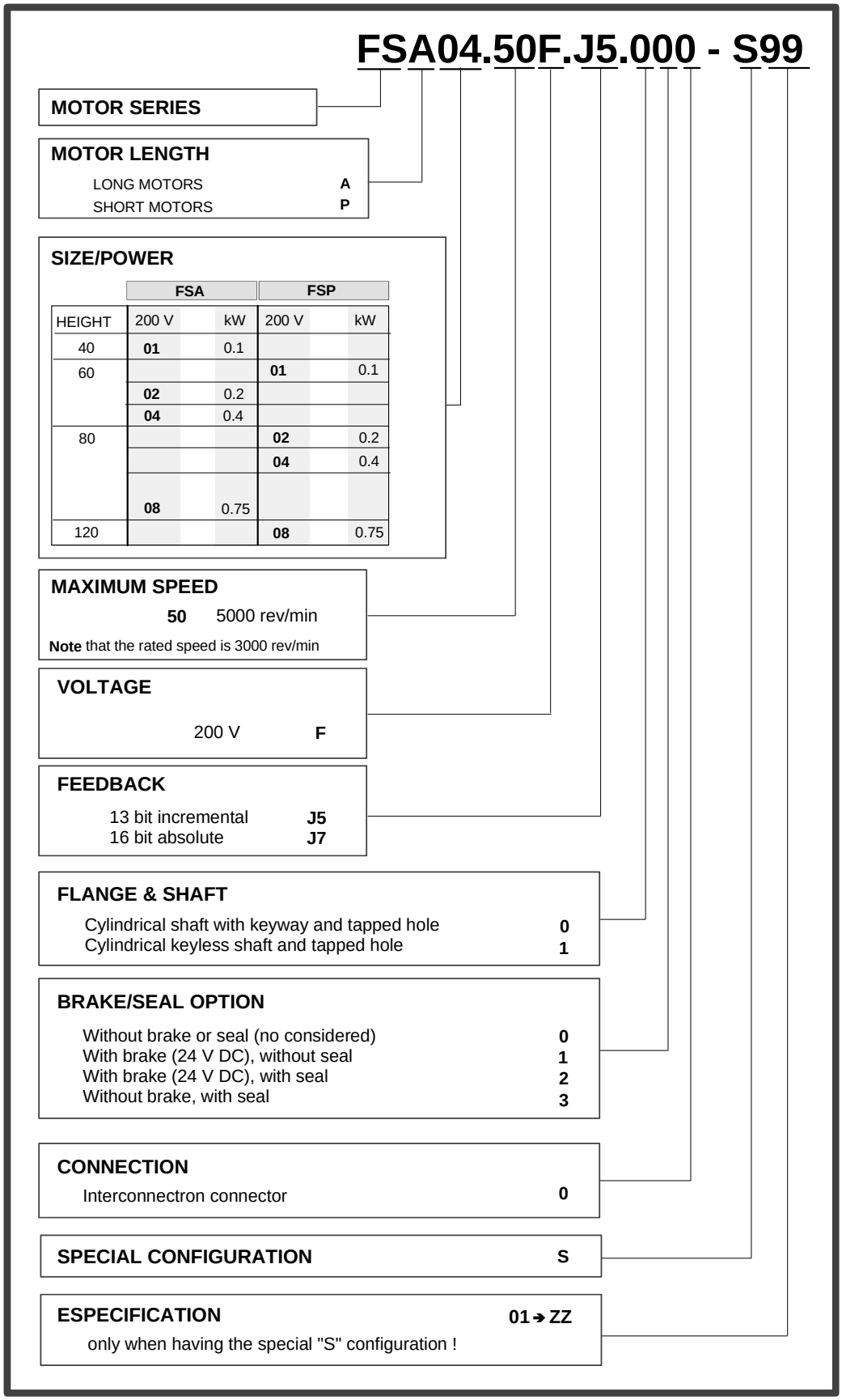
Brake characteristics

FSA and FSP series 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:

Brake	Holding torque	Power consumption	Supply voltage	Mass	Inertia
Motor type	**Nm (lbf·In)**	**W (hp)**	**V DC**	**kg (lbf)**	**kg·cm^2**
FSA01	0.318 (2.814)	6.0 (0.008)	24	0.300 (0.66)	0.0085
FSA02	0.637 (5.637)	6.9 (0.009)	24	0.500 (1.10)	0.058
FSA04	1.270 (11.240)	6.9 (0.009)	24	0.500 (1.10)	0.058
FSA08	2.390 (21.153)	7.7 (0.010)	24	0.900 (1.98)	0.058
FSP01	0.318 (2.814)	8.1 (0.010)	24	0.200 (0.44)	0.029
FSP02	0.637 (5.637)	7.6 (0.010)	24	0.500 (1.10)	0.109
FSP04	1.270 (11.240)	7.6 (0.010)	24	0.500 (1.10)	0.109
FSP08	2.390 (21.153)	7.5 (0.010)	24	1.500 (33.1)	0.875

- The brake must not be used to stop the axis while it is moving.
- The brake must never exceed its maximum turning speed.
- A voltage between 22 V and 26 V releases the shaft. Make sure that no voltage over 26 V is applied that prevent 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



A.C. SERVODRIVE

Introduction

The MCP Innova servodrive (MCPi) family is a variation of MCS Innova (MCSi) 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 two different sources; an external element that has an RS485 serial interface or a USB interface when using a PC, based on the communications protocol ModBus (RTU or ASCII). All drive parameters (except certain exceptions) may be modified on line.

There are three modules of different power offering peak currents of 6.5, 10.5 and 15.0 Arms for single-phase 220 V AC

General characteristics

Their main characteristics are:

- ☐ 220 V AC single-phase voltage supply.
- ☐ Dynamic braking in case of mains failure.
- ☐ PWM IGBTs
- ☐ Serial 16-bit absolute encoder feedback.
- ☐ Programmable encoder simulator output.
- ☐ Two logic inputs for motor control. Speed Enable and Drive Enable.
- ☐ Integrated functions.
- ☐ On-line parameter editing.
- ☐ RS485 communications interface.
- ☐ USB service communication line.
- ☐ Possible communication protocols: ModBus (RTU and ASCII).

Hardware interface characteristics

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

- ☐ An opto-coupled digital output with several functions. By default: IN POSITION.
- ☐ A direct feedback input for an external TTL incremental encoder or for a sinusoidal encoder with Vpp signals.
- ☐ An encoder simulator output that can provide up to the same number of encoder pulses of the motor feedback (serial 16-bit absolute encoder) that can provide 16384 pulses per turn.
- ☐ A dual communications connector that may be connected to any RS485 serial line, ModBus.

☐ A 4-digit status display

☐ 16 inputs and 8 outputs that may be configured as generic I/O or with their pre-programmed function.

☐ 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>.

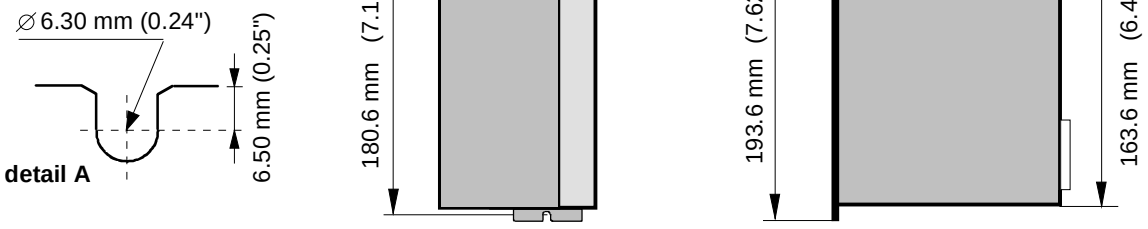
Inputs for selecting the program starting block number <S0, S1, S2, S3, S4>.

Dimensions

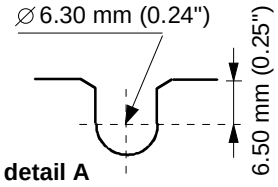
Models:

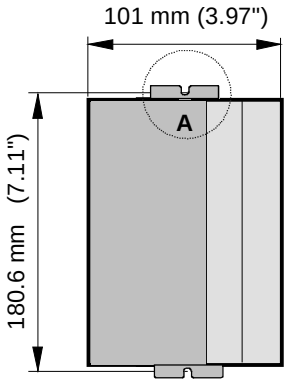
MCPi 07L

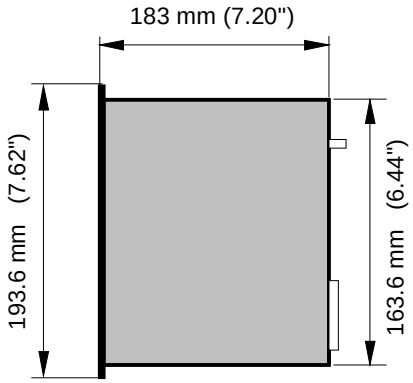
MCPi 11L



Model:
MCPi 15L







Technical data

	MODELS		
	MCPi 07L	**MCPi 11L**	**MCPi 15L**
Rated output current	2.1 Arms	3.5 Arms	5.0 Arms
Peak current (3 s)	6.5 Arms	10.5 Arms	15.0 Arms
Power supply	Single phase 50/60 Hz. Voltage range between 220-10% and 230+10% V AC		
Consumption	12.5 Arms	20.0 Arms	29.0 Arms
Over-voltage protection	390 V DC		
Internal Ballast resistor	----	----	45 Ω
Internal Ballast power	----	----	15 W
Ballast trigger	380 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 1/	IP 20	IP 20	IP 20
Module dimensions	81x163.6x183 mm (3.18x6.44x7.20“)		101x163.6x183 mm (3.97x6.44x7.20“)
Module mass	1.9 kg (4.18 lb)		2.1 kg (4.62 lb)

1/ 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.

Power terminals

Connector X4

- **POWER INPUTS (L1, L2):** 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.

Connector X9

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

Connector X5

- **CONTROL POWER INPUTS (L1, L2, Ground):** 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 mm^2**.

- **ACTIVATION OF THE INTERNAL FAN:** The internal fan that cools the drive's power elements starts when enabling the Drive Enable signal (only on models with integrated fan). It will stop when the heatsink temperature is lower 70°C since the Drive Enable signal is turned off. This system decreases the fan's operating time, thus increasing its useful life.

Conector X3

▶ ANALOG INPUTS AND OUTPUTS

Velocity command, pins 1 and 2: Analog velocity command input for the motor when the module has been configured as speed drive (AP1=2) It admits a range of ± 10 V.

PIN 1	Input -
PIN 2	Input +

Programmable analog input, pins 17 and 18: Input for analog command used for some integrated functions.

PIN 17	Input -
PIN 18	Input +

±12 V, pins 33, 34 and 19: 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.

PIN 34	+12 V
PIN 33	-12 V
PIN 19	GND

Programmable analog output 1, pins 31 and 16 with a voltage range of ±10V and **programmable output 2, pins 32 and 16** with a voltage range of ±10 V.

PIN 31	Output 1
PIN 32	Output 2
PIN 16	Common

▶ ENCODER SIMULATOR

Encóder Simulator Output **, pins 22, 7, 24, 8, 37, 38 and 23:** Outputs of the encoder signals divided by the preset factor, for closing the position loop at the CNC.

PIN 22	A+
PIN 7	A-
PIN 24	B+
PIN 8	B-
PIN 37	Z+
PIN 38	Z-
PIN 23	GND

▶ DIRECT FEEDBACK

Auxiliary Feedback Input **, pins 5, 6, 36, 21, 35, 20, 4 and 3:** Input to connect a second feedback device with TTL signals. The connector provides an auxiliary +5V DC (0.5 A max) for the feedback device (see pin 4).

PIN 6	A+
PIN 5	A-
PIN 21	B+
PIN 36	B-
PIN 20	Z+
PIN 35	Z-
PIN 3	GND
PIN 4	+ 5 V DC (0.5 A max.)

▶ ENABLES

Drive Enable input, pin 13: No current circulates through the motor stator winding at 0 V DC, thus it no longer supplies torque. It is activated with +24 V DC.

Speed Enable input, pin 15: At 0 V DC, it forces an internal zero velocity command. It is activated with +24 V DC.

Common to inputs Drive Enable and Speed Enable pin 14: Reference point for inputs Drive Enable and Speed Enable.

+24 V DC and 0 V DC, pins 43 and 44: Output of the internal 24 V DC power supply that may be used for the control of inputs Drive Enable and Speed Enable as well as the programmable digital input. It offers a maximum current of 50 mA limited internally.

PIN 13	DRIVE ENABLE
PIN 15	SPEED ENABLE
PIN 14	Pin common to inputs DRIVE ENABLE and SPEED ENABLE
PIN 43	+24 V DC of the auxiliary power supply (max. 50 mA)
PIN 44	GND of the auxiliary 24 V DC power supply

▶ DIGITAL INPUTS AND OUTPUTS

Programmable digital input, pins 11 and 12: Digital input (servo drive at +24 V DC and 0 V DC) used as input for some integrated functions.

Programmable digital output, pins 27 and 28: Optocoupled open collector output that reflects the output of some integrated functions.

▶ DRIVE OK

Drive Ok, pins 29 and 30: Relay contact that closes when the internal status of the drive control is OK.

Note that this relay contact must be necessarily included in the electrical maneuver.

▶ **RELAY FOR INTEGRATED SAFETY**

Safe-disable relay, pins 41 and 42: Second, normally closed contact (NC) used as an external acknowledgement of the status of the integrated-safety relay.

Note that this relay contact must be necessarily included in the electrical maneuver.

▶ **CHASSIS**

Metal housing of the connector: Drive chassis connection point.

Connector X1

▶ COMMUNICATIONS

USB-type A **double parallel** connector for fast interconnection between various units (ModBus protocol) via RS485 serial line. It has a line terminating resistor selector whose status is set as follows:

ON	Resistor connected
OFF	Resistor not connected

Connector X2

▶ MOTOR FEEDBACK INPUT

Standard IEEE 1394 type connector for input of the serial encoder signals, installed on the motor itself for position + speed feedback.

Connector X6

▶ SERVICE

Standard USB mini AB type connector to connect a PC for setting parameters, monitoring system variables and updating the firmware of the unit using the WinDDSSetup application for PC. Any standard USB cable with a miniA or miniB connector may be connected at the drive side.

Connector X10

▶ **INPUTS (I/O)** (Dig. Inputs)

GND, pin 1: GND pin. Reference of all the signals of this connector.

S0, S1, S2, S3 and S4, pins 2, 3, 4, 5 and 6, 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 +24V and the block number must be in binary format. Reflected mark REG1.

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

STOP input, pin 8: A 0V 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, the command is just canceled. Reflected mark LV16.

RESET input, pin 9: In automatic mode and positioning block in execution, a +24V 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: 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:"positive Jog" speed push-button input. Once the jog mode has been selected, applying +24V 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 degrees/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:"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: Input for the right 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

REV FW input. LIMIT, pin 14: 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: Home search command input; a home search ordering switch may be connected to it. This input is activated at +24V. Reflected command PC148.

HOMING SW input, pin 16: Home search cam input where the home switch is connected. The activation of this input depends on PP147.1.

FAST INPUT, pin 17: “External Fast IN” input. A +24V pulse longer than 1 ms at this input activates the INIFAST mark that is interpreted in the positioning table.

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

Connector X11

▶ **OUTPUTS (I/O)** (Dig. Outputs)

EXT. +24V, pin 1: Input for the external +24V used to activate the outputs **OUT1 ... OUT8**.

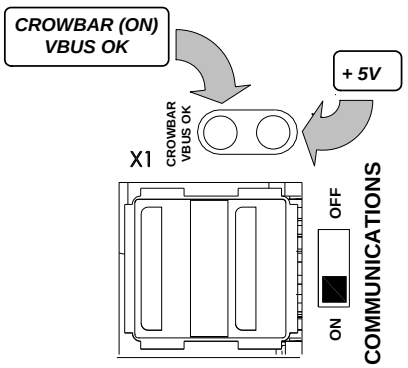
EXT. GND, pin 2: Input for external GND used to activate the outputs **OUT1, ... OUT8**.

OUT1, ... OUT8, pins 3, 4, 5, 6, 7, 8, 9 and 10, respectively: Open-emitter outputs, active at +24V 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.

Indicators

+5V: LED located on top of connector X1. When lit, it indicates that the internal +5V are being applied.

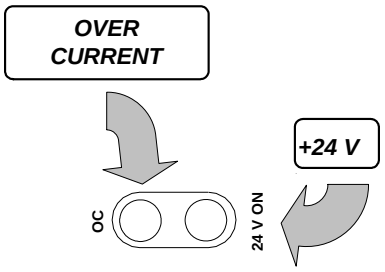
CROWBAR (ON) / VBUS OK: Two-color (green/red) light indicator located next to the +5V LED. It indicates its status according to the following table:



STATUS OF THE LED CROWBAR (ON) / VBUS OK

OFF	No voltage at power circuit
ON (GREEN)	Voltage at power circuit
ON (RED)	The internal bus voltage is higher than preset values and the recovery resistor has been activated

OC: Over **C**urrent. Light indicator (LED) located next to the + 24 V ON. When ON (red LED), it indicates over-current at the outputs.
+24 V ON: Light indicator (LED) located on top of connector X11. When ON (green LED) it indicates that the input/output (I/O) board is receiving +24 V.



STATUS OF THE LED's OF THE I/O BOARD

Over current

OFF	Output current ok
ON (RED)	Over current at the outputs

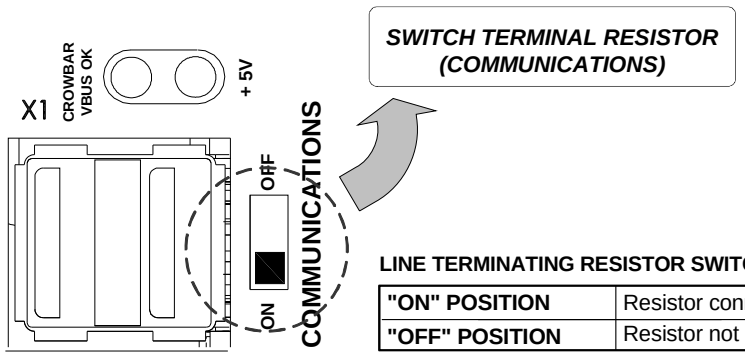
+24V ON

OFF	No voltage at the IOs board
ON (GREEN)	Voltage at the IOs board

Push-buttons and switches

RESET: Push-button for resetting the system.

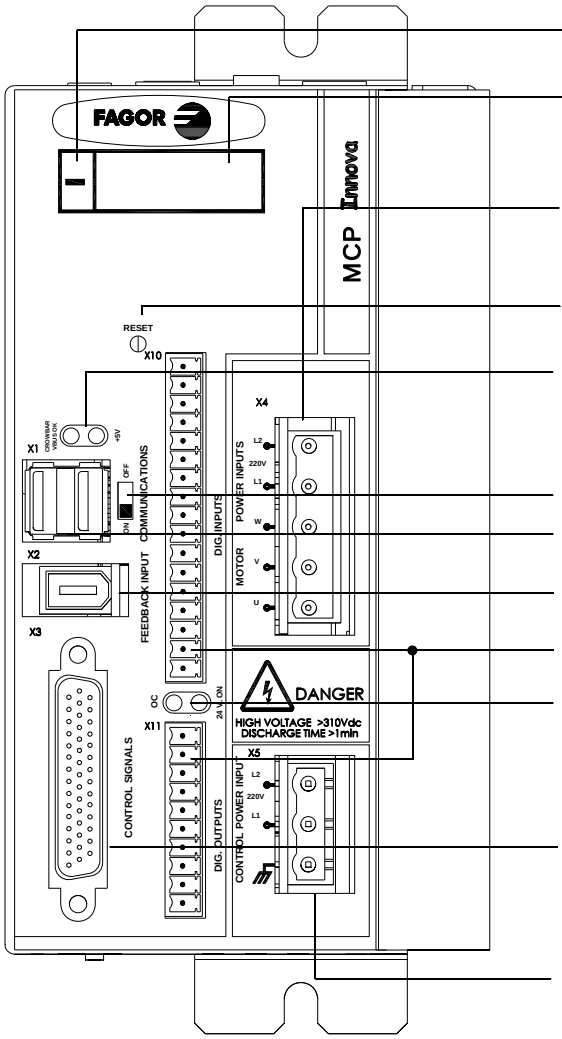
TERMINATING RESISTOR (COMMUNICATIONS): This switch located next to the connector X1 (front of the module) may be used to connect or disconnect the line terminating resistor in RS485 communications.



LINE TERMINATING RESISTOR SWITCH POSITION

"ON" POSITION	Resistor connected
"OFF" POSITION	Resistor not connected

Front view of the module



Sign indicating display

Four 7-segments displays

Mains input terminals for the module voltage supply (single phase 220 V AC) and voltage output terminal to the motor (three-phase 220 V AC).

Reset button

LED's indicating that there is voltage at the bus, that the crowbar is activated **VBUS OK/ CROWBAR (ON)** and that there are internal **+ 5V**.

Line terminating resistor on/off selecting switch.

Module connection via RS485 serial line.

Encoder signal input.

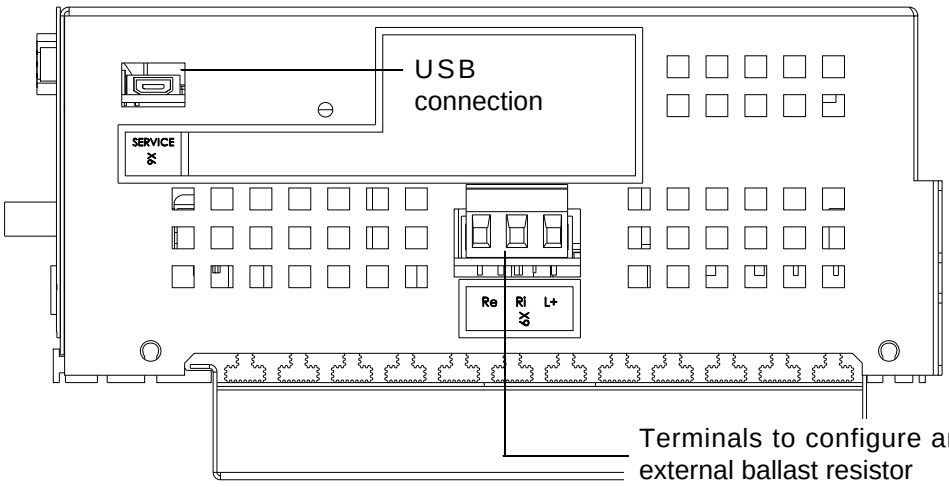
16 inputs and 8 outputs that may be configured as generic I/O or with their pre-programmed function.

LED's indicating over-current at the digital outputs (**OC: O**ver **C**urrent) and presence of **+24 V ON** on the I/O board.

Control signals. Analog inputs and outputs, encoder simulator, direct feedback, enables, digital inputs and outputs, drive ok, integrated safety relay, chassis.

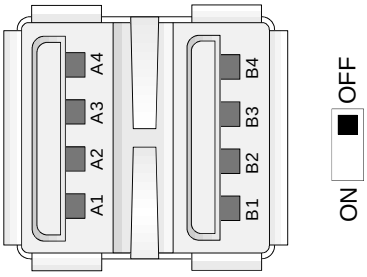
Input terminals for the voltage supply of the control circuits from mains. (single-phase 220 V AC).

Top view of the module



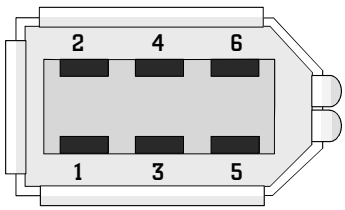
Terminals to configure and connect the external ballast resistor

Pinout of the connectors



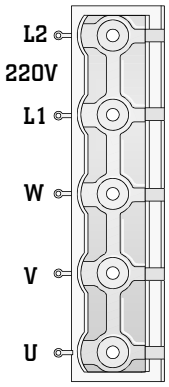
▶ COMMUNICATIONS (X1)

Pin	Signal	Description
A1, B1	N.C.	Not connected
A2, B2	TxD/RxD - (RS485)	TxD/RxD signal - (RS485)
A3, B3	TxD/RxD + (RS485)	TxD/RxD signal + (RS485)
A4, B4	N.C.	Not connected
	Chassis	Housing



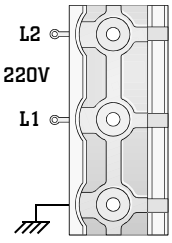
▶ FEEDBACK INPUT (X2)

Pin	Signal	Description
1	+ 5 V	Voltage supply for the encoder
2	GND	Encoder voltage supply GND
3	+ BAT	+ battery (with absolute encoder)
4	- BAT	- battery (with absolute encoder)
5	+ 485	Encoder communication
6	- 485	Encoder communication
	Chassis	Connector housing



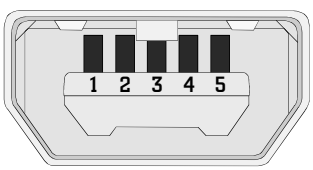
▶ POWER INPUTS & MOTOR (X4)

Pin	Signal	Description
L2	S phase	220 V mains voltage input terminals.
L1	R phase	
W	W phase	Output terminals for the voltage applied to the motor (200 V).
V	V phase	
U	U phase	



▶ CONTROL POWER INPUTS (X5)

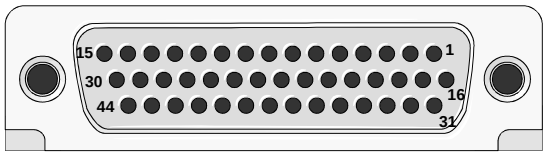
Pin	Signal	Description
L2	S phase	220 V mains input terminal for the control circuits.
L1	R phase	
	Chassis	Ground



▶ SERVICE (X6)

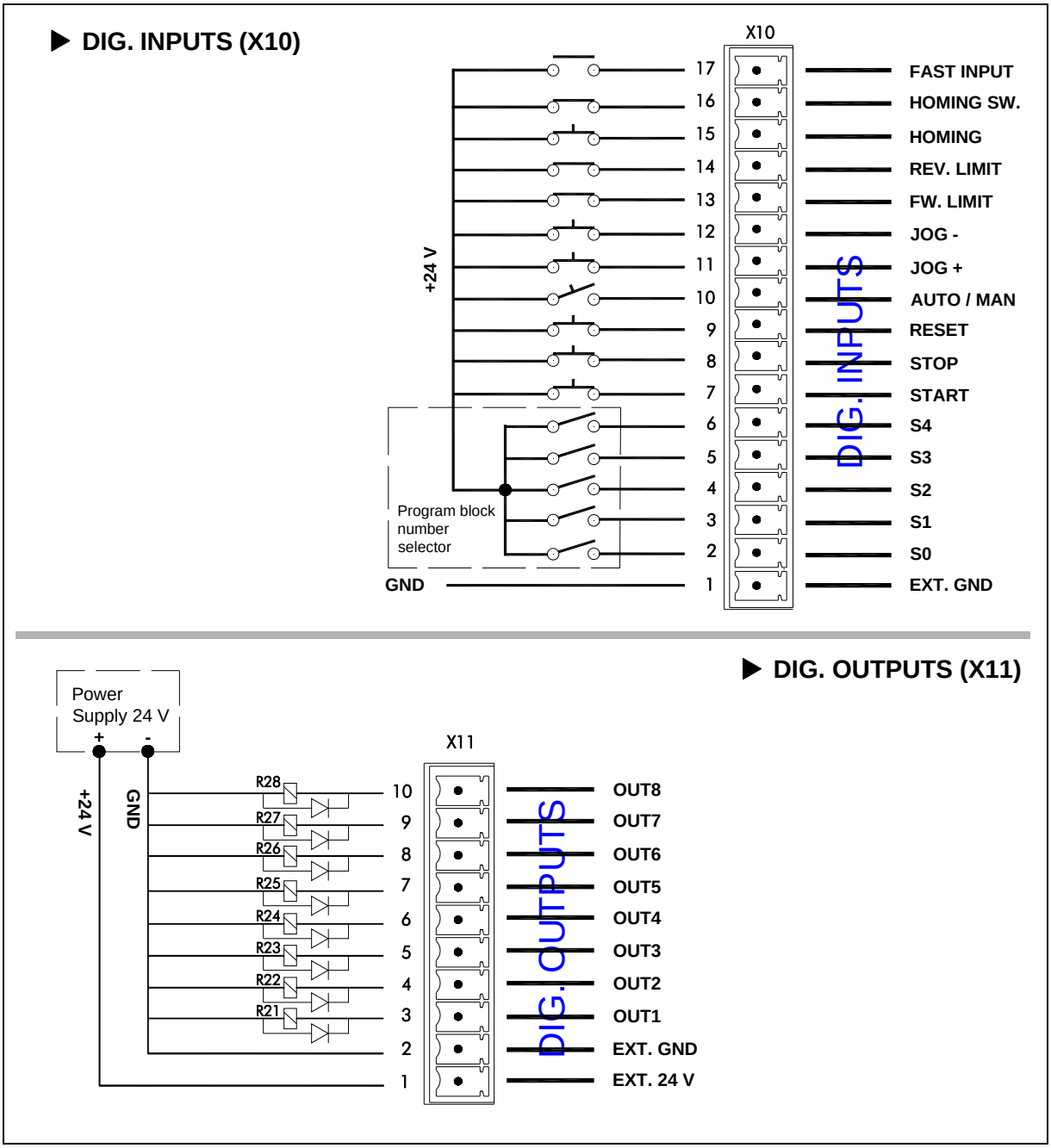
Pin	Signal	Description
1	N.C.	Not connected
2	DMO	DMO
3	DPO	DPO
4	N.C.	Not connected
5	GND	GND
	Chassis	Housing

▶ CONTROL SIGNALS (X3)



Pin	Signal	I/O	Description	
2	ANALOG VELOCITY COMMAND INPUT	I	Input +	Range ±10 V, impedance 56 kΩ
1			Input -	
18	PROG. ANALOG INPUT	I	Input +	Range ±10 V, impedance 56 kΩ
17			Input -	
31	PROG. ANALOG OUTPUT	O	Programmable analog output 1	Range ±10 V
32			Programmable analog output 2	
16			GND	
34	AUX. ±12 V	O	+12 V (20 mA max) output	
33			-12 V (20 mA max) output	
19			GND	
43	AUX 24 V DC	O	+24 V DC (50 mA max) output	
44			GND AUX 24 V DC	
13	DRIVE ENABLE	I	DRIVE ENABLE input (range from 0 to 24V DC)	
15	SPEED ENABLE	I	SPEED ENABLE input (range from 0 to 24V DC)	
14	COMMON DRIVE	---	Common to inputs DRIVE ENABLE and SPEED ENABLE	
11	PROG. DIGIT. INPUT	I	Programmable digital input +	Range from 0 to 24 V DC
12			Common of the digital input -	
27	PROG. DIGIT. OUTPUT	O	Programmable digital output (collector)	100 mA max, 50 V DC
28			Programmable digital output (emitter)	
29	DRIVE OK	O	Open contact of the DRIVE OK signal (0.6 A - 125 V DC, 0.5 A - 110 V DC, 2 A - 30 V DC)	
30				
22	ENCODER SIMUL. OUT	O	A + signal	Encoder simulator outputs. (range from 0 to 5 V)
7			A - signal	
24			B + signal	
8			B - signal	
37			Z + signal	
38			Z - signal	
23			GND	
6	AUXILIARY	I	A + signal	
5			A - signal	
21			B + signal	
36			B - signal	
20			Z + signal	
35			Z - signal	
4		O	+ 5 V. Supply for the direct feedback device (0.5 A max)	
3			Supply GND for the direct feedback device	
41	SAFETY RELAY	O	Second contact (NC normally closed) used as external acknowledgment of the status of the integrated safety relay.	
42				

Pins 9, 10, 25, 26, 39 and 40 are NC (not connected).
The < I/O > column indicates whether it is an input signal (**I**nput) or an output signal (**O**utput) through the relevant pin at connector X3.



Sales reference

Codes of the sales reference of Fagor MCPi drives.

MCP INNOVA DIGITAL DRIVE

EXAMPLE. MCPi - 07 L

model: MCP Innova

current (A)

	rated	peak (3 s)
07	2.1	6.5
11	3.5	10.5
15	5.0	15.0

power supply: 220 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 will admit flange mounts: IM B5 and IMV1.

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

☐ Mount it somewhere that is dry, clean and accesible for maintenance.

> **Remember that** the degree of protection is IP 55 (standard), shaft section excluded.

☐ It must be easily cooled.

☐ Avoid corrosive or flammable environments.

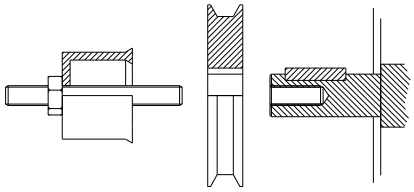
☐ Guard the motor with a cover if it is exposed to splashes.

☐ 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.

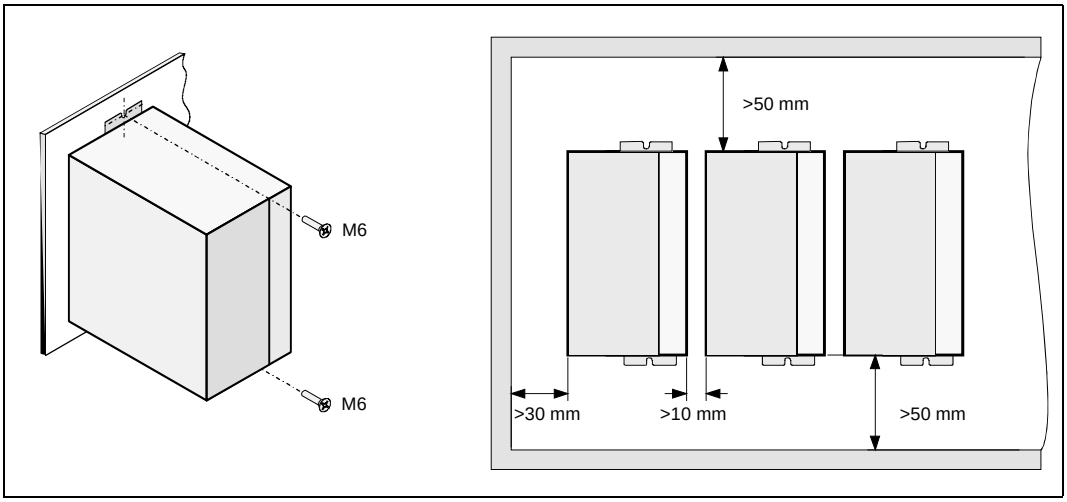


At the Drive

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.



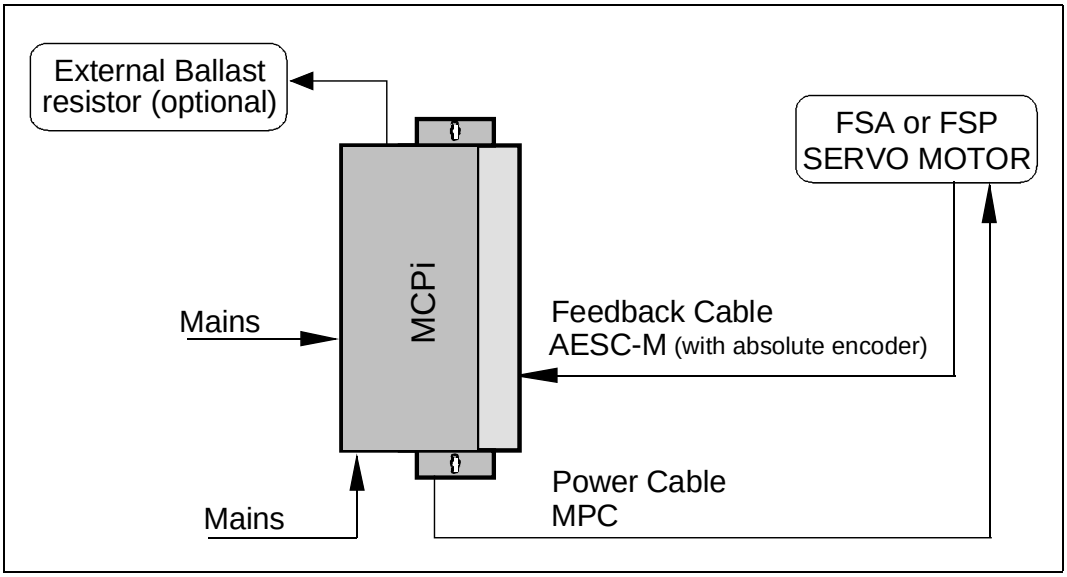
About the connection

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 housing of connector X3.

Keep the signal cables away from the power cables.

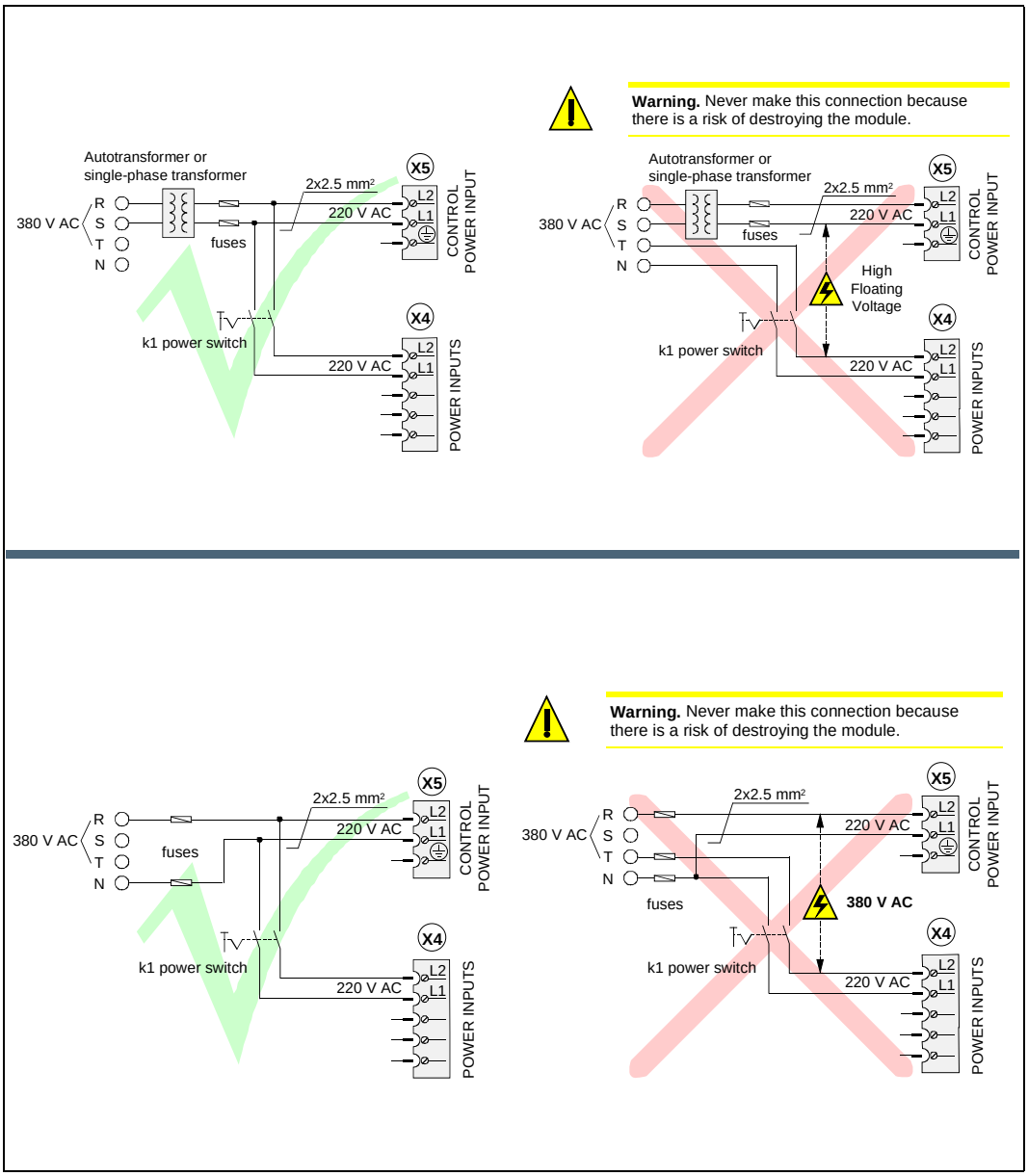
Electrical connections

Basic interconnection diagram



Power connection. Mains - Drive

The drive voltage supply is single phase and does not require a transformer.



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)
MCPi 07L	6.5	16
MCPi 11L	10.5	16
MCPi 15L	15.0	25

Note. A thermal switch may optionally replace the fuses.

Power connection. External Ballast resistor

If the application requires a Ballast resistor with a power greater than the one indicated in this table according to model:

Model	Internal resistor Ri		Maximum power that may be dissipated in Ri	External resistor
MCPi 07L	-----	-----	-----	Max. value 65 Ω Min. value 45 Ω
MCPi 11L	-----	-----	-----	
MCPi 15L	45 Ω	60 W	15 W	

therefore:

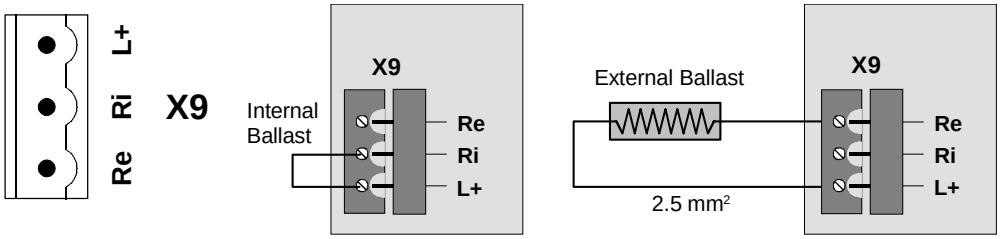
☐ Remove the cable joining the terminals **Ri** and **L+**.

☐ Install the external resistor between the terminals **Re** and **L+.**

☐ Make sure that the resistance (Ohms) of the external ballast resistor is exactly the same as that of the internal resistor of that module. See the technical data table.

☐ Use KV41 to indicate to the drive that an external ballast resistor has been connected.

X9. Connector on top of the drive module.



Power connection. Inductance for reducing high frequency harmonics

It is recommended to connect an inductance at the input of one of the power phases **L1 or L2** of the drive (connector X4) to reduce high frequency harmonics coming from mains with a value of 5 mH and and rms current of 6 Arms. This inductance reduces the disturbances in mains, but it does not ensure compliance with CE regulations. **Connect the inductance as shown in the figure.**

Power connection. Mains filters to suppress electromagnetic interference

In order for the Fagor DDS servo drive system to meet the European Directive on electromagnetic compatibility 2004/108/EC, the mains filter FAGOR FEHV-XXX must be inserted (see the table in the next section “connection”) at the input of the MCPi (power phases **L1** and **L2** of connector X4) against electromagnetic interference.

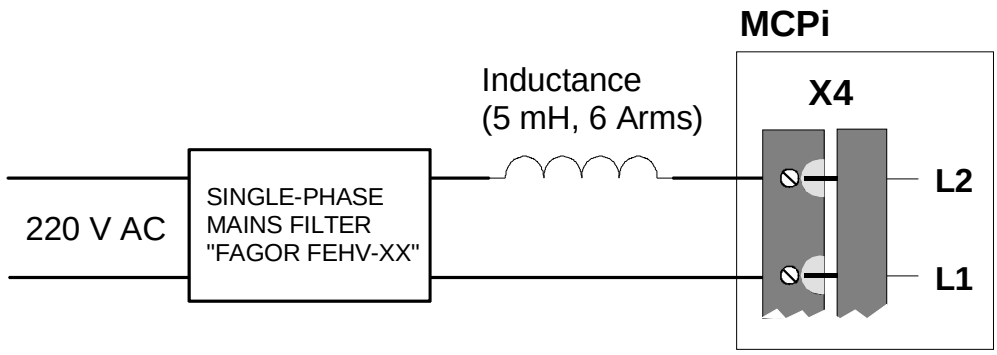
Connection

Install the proper filter that can handle the sum of the rated Arms currents of the MCPi drives installed in the system.

Mains filters	Imax (A)
FEHV-10Z	10
FEHV-16Z	16
FEHV-30B	30

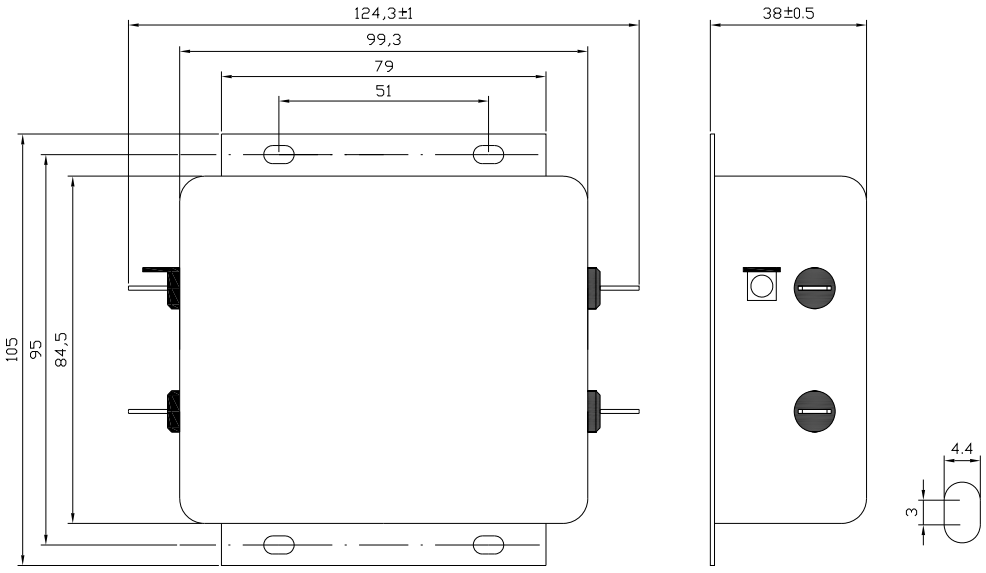
Remember that the rated currents of the drives are 2.1 A for the MCPi 07L; 3.5 A for the MCPi 11L and 5 A for the MCPi 15L.

Connect the filter using 6.3 mm Faston terminals as shown in the figure.

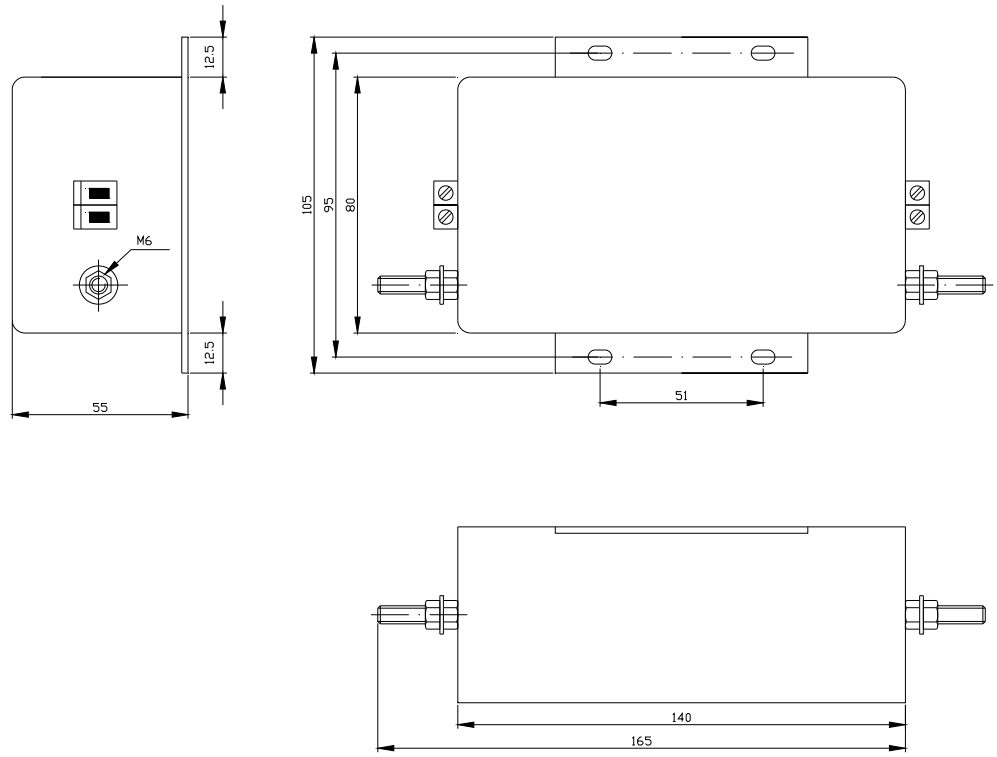


Dimensions

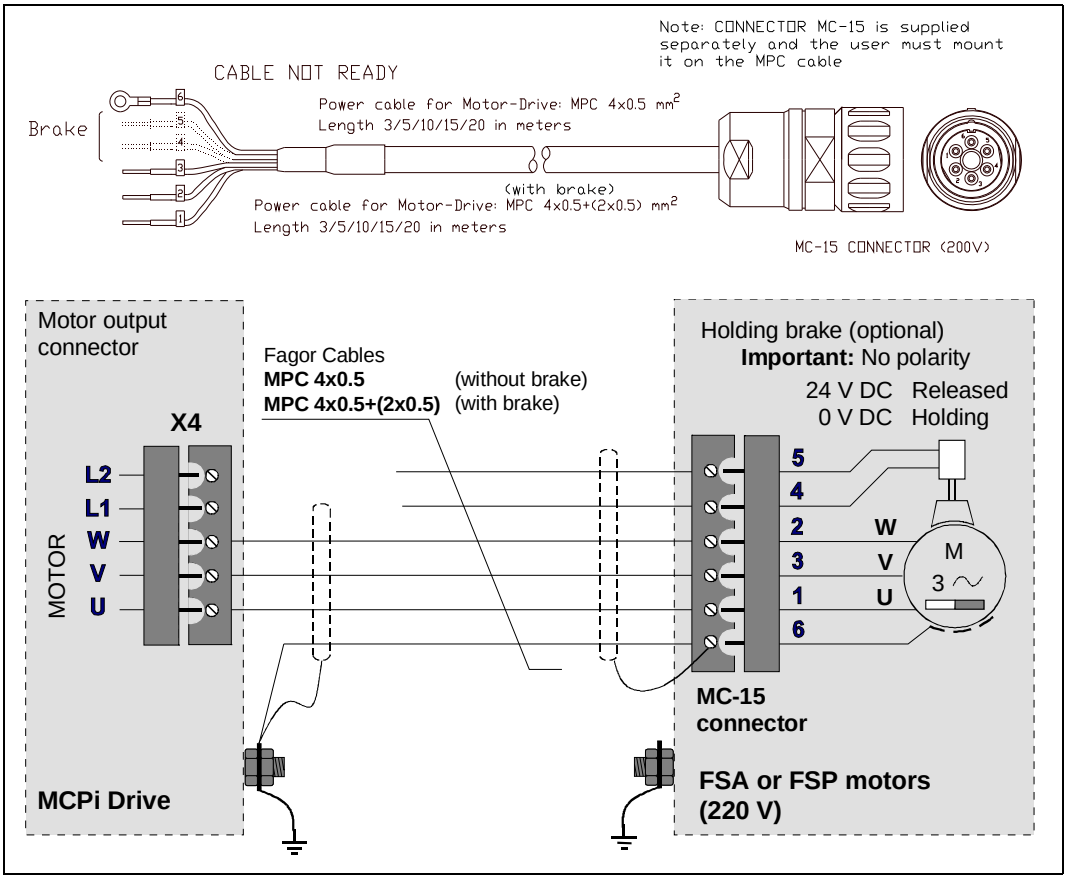
Mains filters FAGOR FEHV-10Z/16Z



Mains filters FAGOR FEHV- 30B



Power connection. Drive - motor

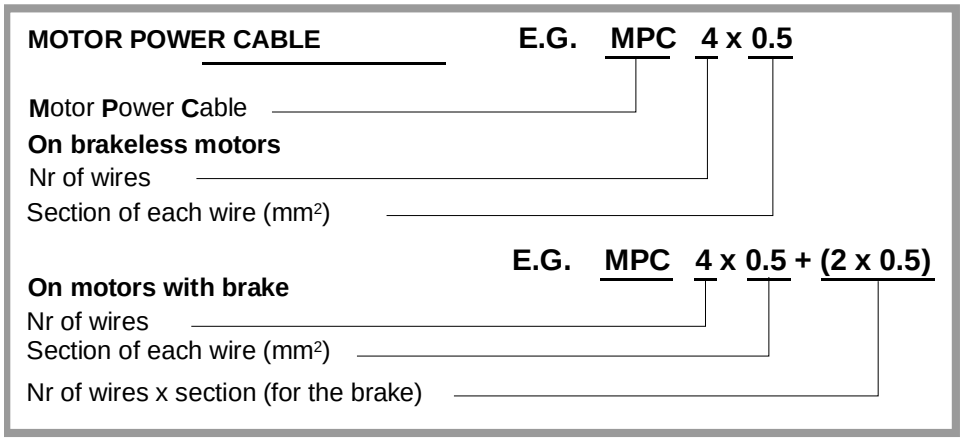


Power cables

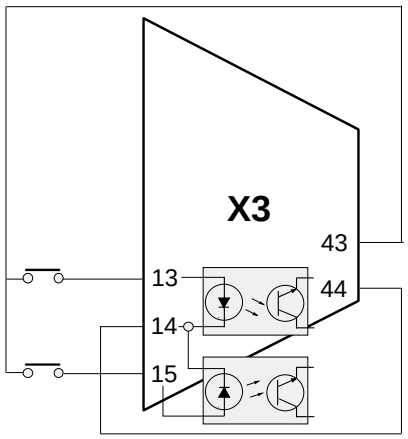
If the motor does not have a	If the motor has a brake
MPC - 4 x 0.5	MPC - 4 x 0.5 + (2 x 0.5)

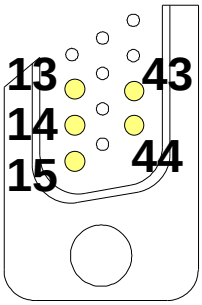
Note. The length of the MPC power cable must be specifically ordered (in meters).

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



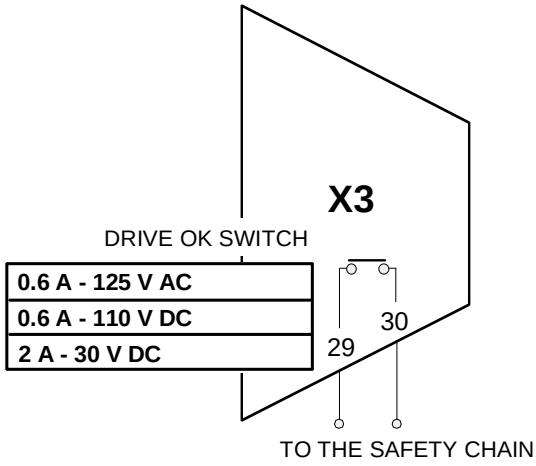
▶ Enable signals using 24 V



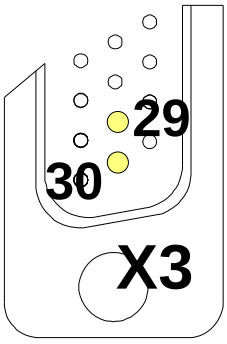


Pin	Signal
43	24 V
44	GND
13	DRIVE ENABLE
14	COMMON
15	SPEED ENABLE

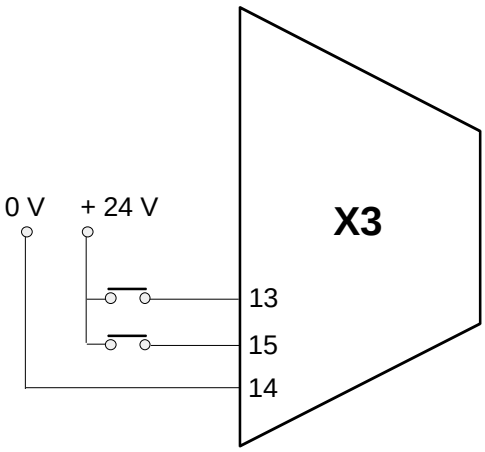
▶ Signal indicating that the Servo Drive is running properly



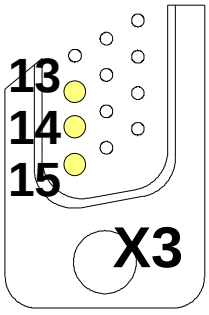
Pin	Signal
29	DRIVE OK
30	



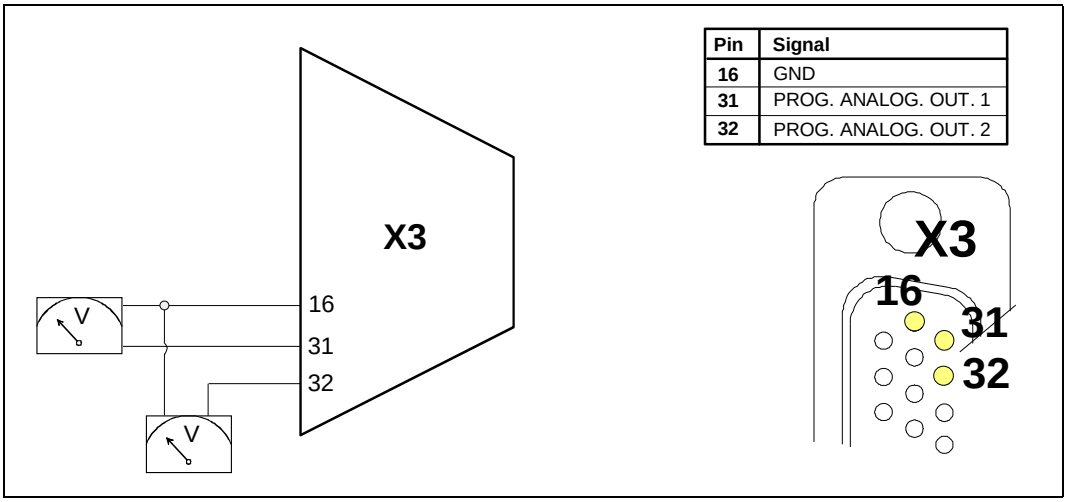
▶ Enable signals



Pin	Signal
13	DRIVE ENABLE
14	COMMON
15	SPEED ENABLE

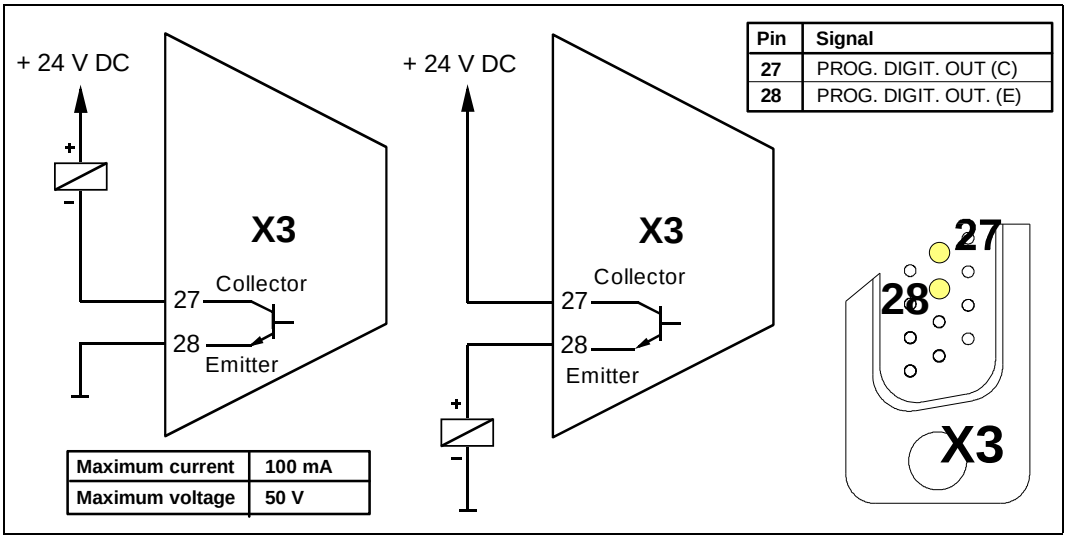


▶ Monitoring signals



Pin	Signal
16	GND
31	PROG. ANALOG. OUT. 1
32	PROG. ANALOG. OUT. 2

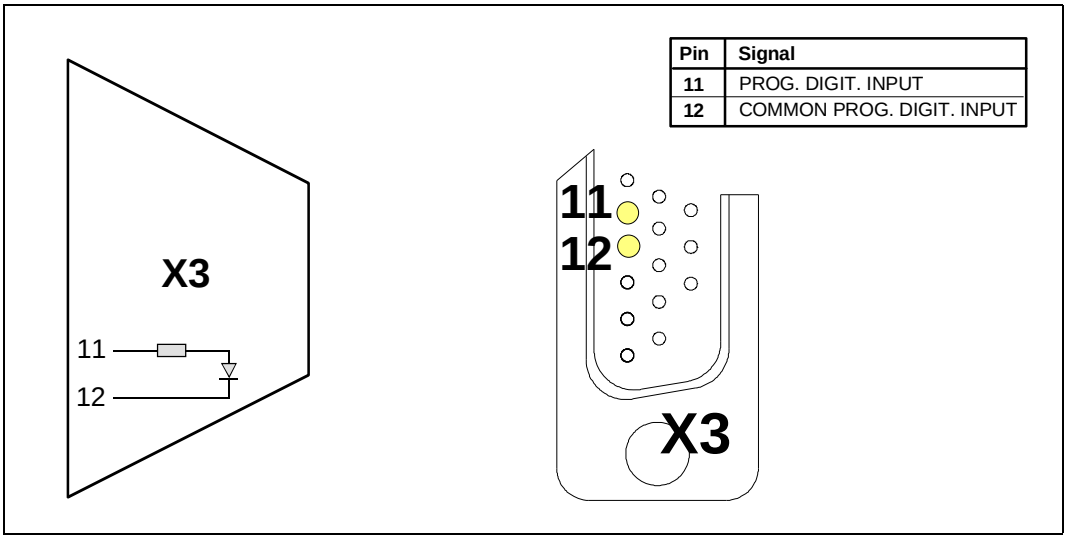
▶ Programmable digital outputs



Pin	Signal
27	PROG. DIGIT. OUT (C)
28	PROG. DIGIT. OUT. (E)

Maximum current	100 mA
Maximum voltage	50 V

▶ Programmable digital input



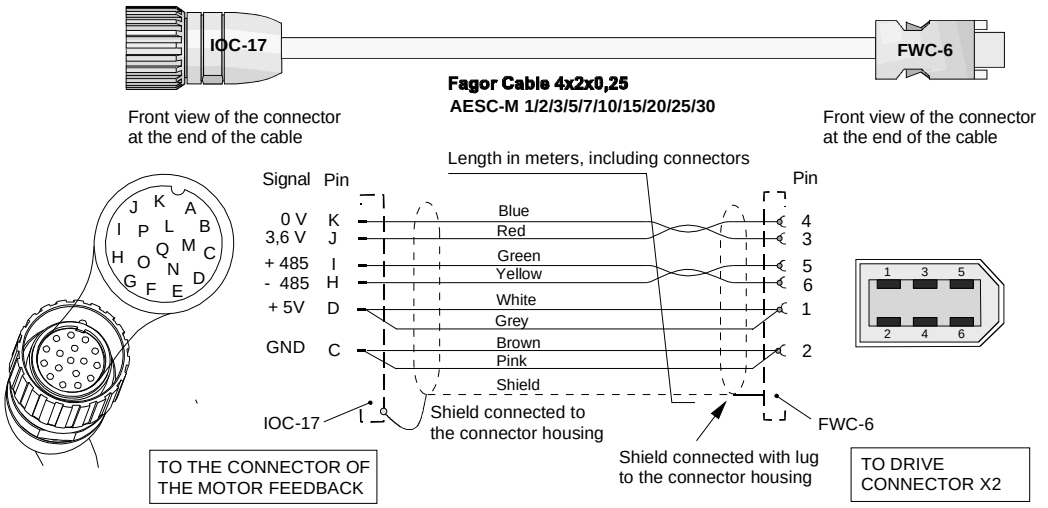
Pin	Signal
11	PROG. DIGIT. INPUT
12	COMMON PROG. DIGIT. INPUT

Encoder feedback connection

The signals generated by the encoder are taken to connector (X2) **FEEDBACK INPUT** of the MCPi drive. The MCS amplifies these signals and may divide their frequency. The division factor is given by the values of parameter EP1 and the sequence between A and B by parameter EP3. The MCPi drive outputs these signals through (X3) **CONTROL SIGNALS**. The encoder must be mounted on to the motor shaft and cannot be installed anywhere else in the transmission chain.

The motors may have use an incremental encoder J5 (13 bit) or an absolute encoder J7 (16 bit). But, when choosing an absolute encoder to use this characteristic, you must also obtain a battery with a mounting clip “Battery for Absolute Encoders in FS motor”. The battery will not be necessary if you only wish to increase the resolution.

The connection cable is:



Sales reference of the Fagor feedback cable

The sales reference of the feedback cable is AESC-M-☐☐ where the last two digits shown as “☐☐” indicate its length in meters. For example the AESC-M-**3** is a 3 meter encoder cable. The available lengths are: 1, 2, 3, 5, 7, 10, 15, 20, 25 and 30 meters.

Remember that this encoder cable may be used both under static and dynamic work conditions.

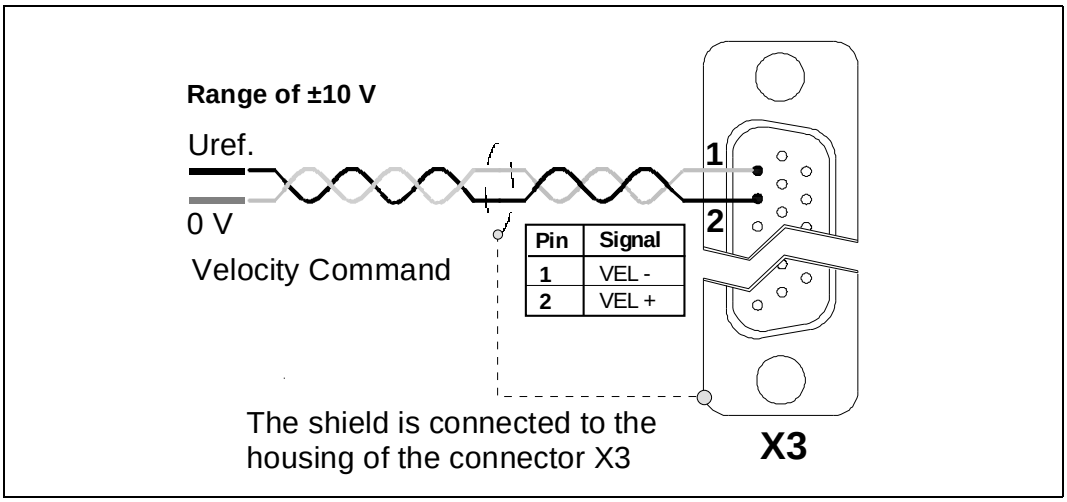
Sales reference of Fagor feedback extension cables

Fagor also provides, upon request and in meters, the feedback cable (without connectors) with sales reference **FSA/FSP Encoder Cable** up to 30 meters in case the user wants to make his own cable.

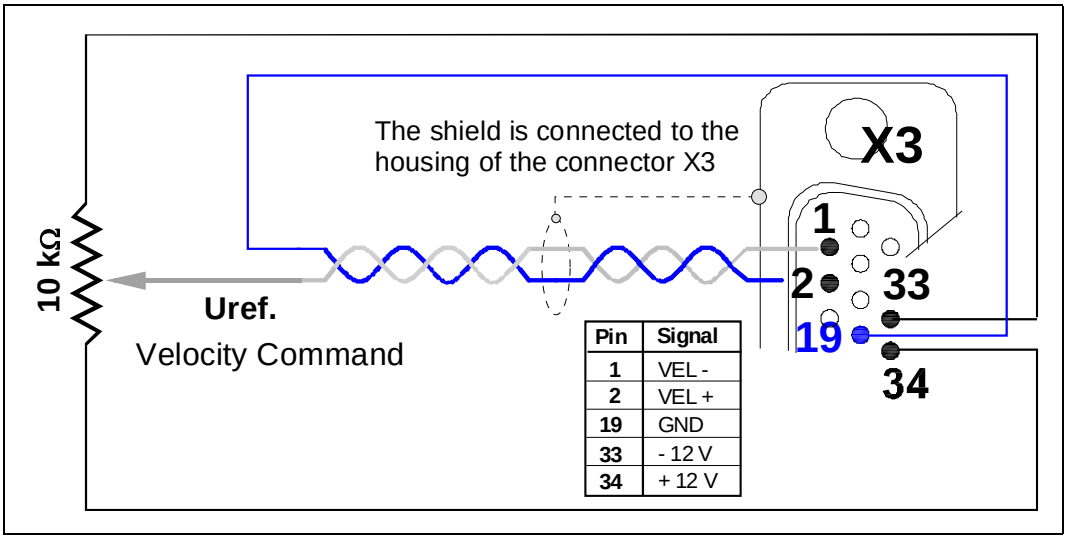
Analog command signal connection

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 housing of the 44-pin connector X3 (control signals). The input impedance of the velocity command is 56 kΩ (a range ±10V).

▶ **Differential velocity command input**



▶ **Generation of the inverted velocity command and application to the drive**



Service port. USB line

Connecting a PC compatible computer with an MCP Innova drive via USB (**U**niversal **S**erial **B**us) makes it possible to set and monitor system variables facilitating its adjustment. The motor table may be updated through this line. The connection cable is a standard USB cable with a mini A or mini B type male connector at the drive side. The maximum length of the cable should not exceed 3 meters.

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. The use of fuses is a must.

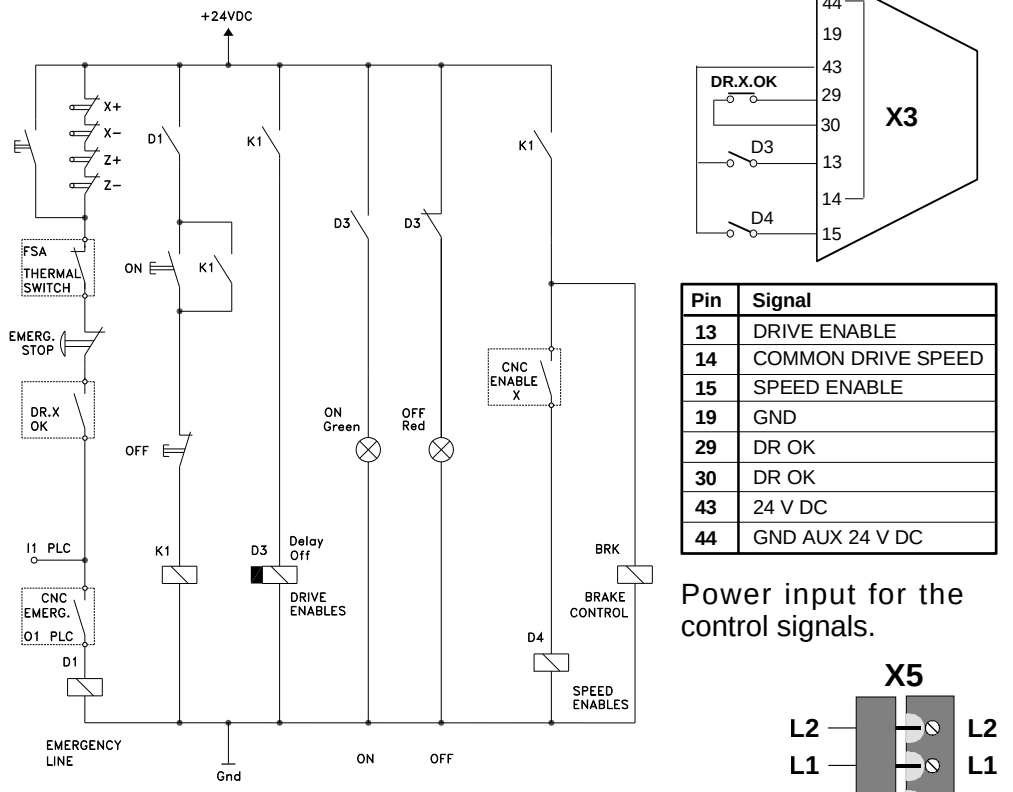
Mains connection and maneuver diagram

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.

Connection diagram of the electrical cabinet.

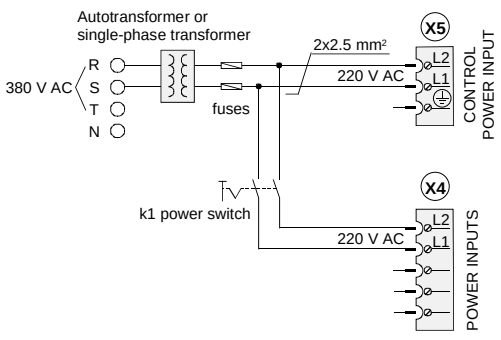


Pin	Signal
13	DRIVE ENABLE
14	COMMON DRIVE SPEED
15	SPEED ENABLE
19	GND
29	DR OK
30	DR OK
43	24 V DC
44	GND AUX 24 V DC

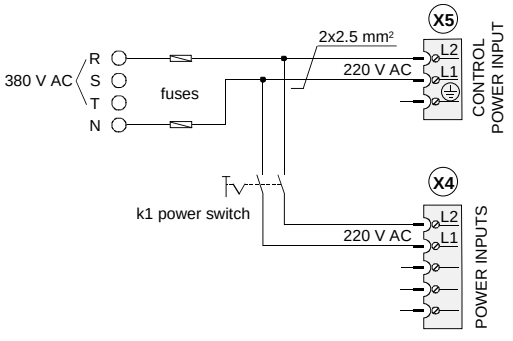
Power input for the control signals.

Power connection diagrams

With transformer



Without transformer

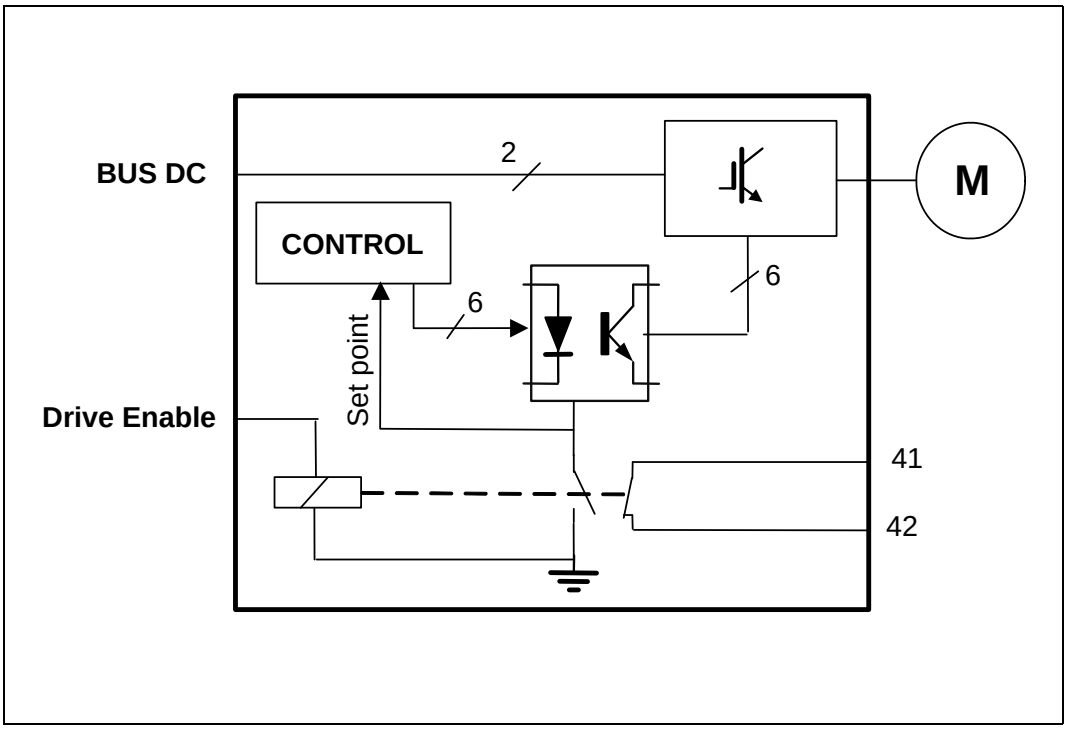


Integrated safety

The **S**afe **D**isable function **(SD)** offered by Fagor MCP Innova drives permits disabling the power output of the drive making sure that the motor torque is eliminated as a safe situation.

This function is available through the "Drive Enable" section so called in standard Fagor servo drive systems. Techniques and elements approved to be used in safety systems have been considered for its design and internal operation.

Thus, with a conventional drive (without SD), a contactor would have to be installed to assure a safe disable of the motor. However, using the safety techniques (implemented in Fagor MCP Innova drives) guarantees the same or greater safety without having to use external contactors, thus saving material and room in the electrical cabinet.

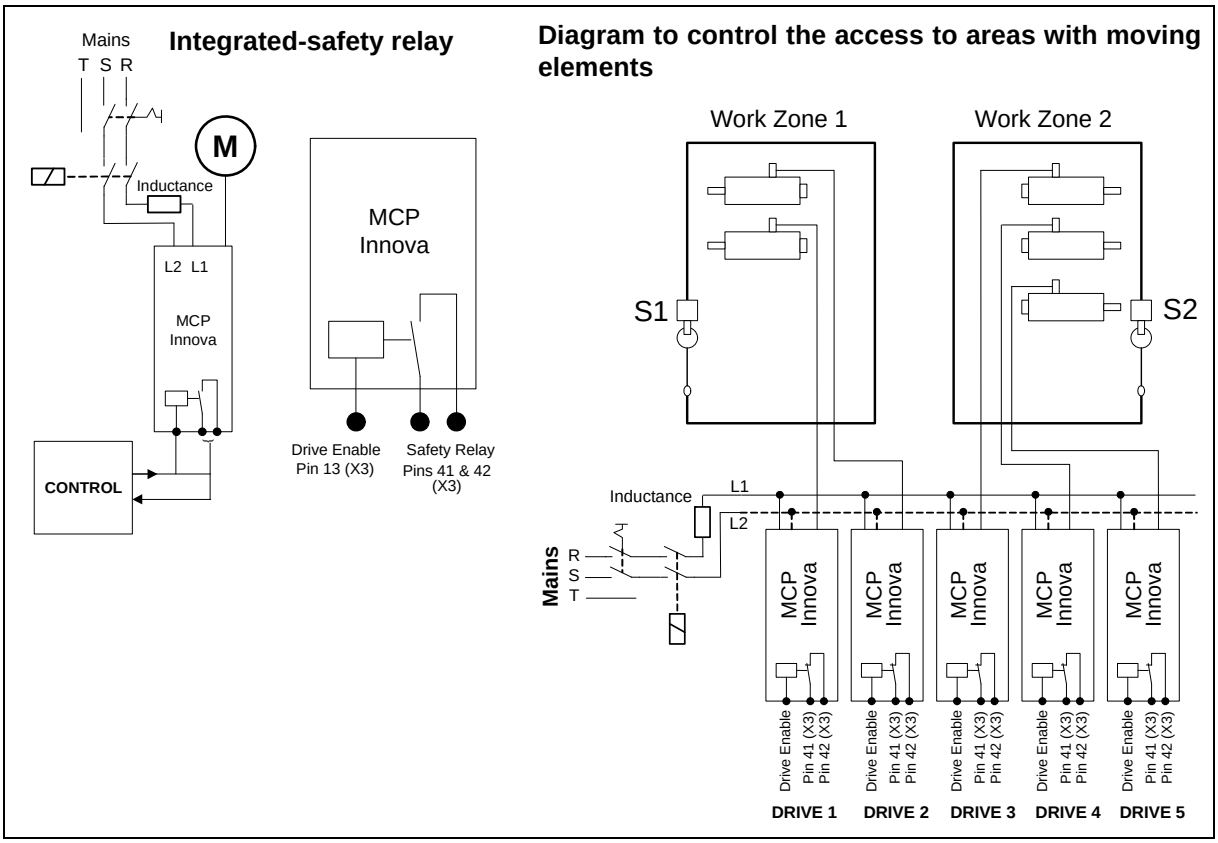


The "Drive Enable" pin already available on conventional Fagor drives works the same way on drives with **S**afe **D**isable although it has been implemented keeping the safety principles and protocols in mind.

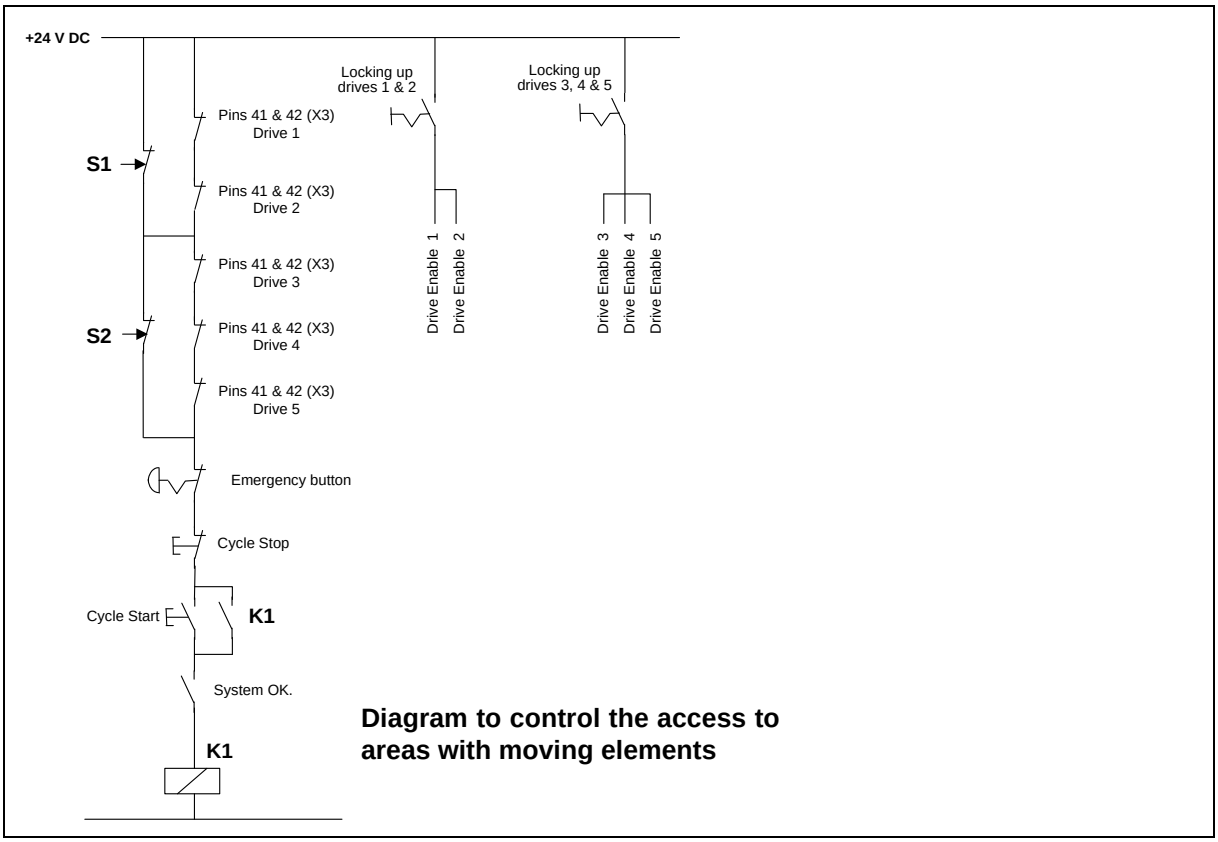
For that, a safety relay with guided contacts has been considered so:

- ☐ The first contact (NA) enables the power inverter and sets the control part to rest assuring a redundancy when locking up.
- ☐ The second contact (NC) is used as an external acknowledgement of the status of the safety relay. This contact is available between pins 41 and 42 of connector X3 located on the face of the module.

The following figure shows the diagram of the safe disable (**SD**) of an MCP Innova and as an example of application, a diagram to control the access to areas with moving elements:



The diagram to control the access to areas with moving elements is:



PC connection via USB. WinDDSSetup

The WinDDSSetup is a Fagor application for PC. The operator can use the application's interface to read, modify, save to a PC file and download from a PC file all the parameters and variables of the drive and check the status of the motor-drive combination; thus making the final adjustment of the servo drive system easier, faster and more comfortable. This also makes it easier to manufacture many machines that have MCP Innova units. When installing the WinDDSSetup, the USB drives are also installed. These drivers generate an additional virtual COM port to those already used by the PC and it will only be present when the unit is connected and is applied control or power voltage. This is why, **the unit should be connected first** and **then run WinDDSSetup**.

Note that when the unit is connected to the PC for the first time, the operating system will show the message <new hardware detected> twice on the monitor screen.

Do the <default> installation, recommended by the system and ignore the message regarding the incompatibility tests of the software with the operating system Windows® XP that comes up during the installation process. Go on by pressing the <Continue> button. This message refers to the drives that have not been certified yet. However, they are fully functional.

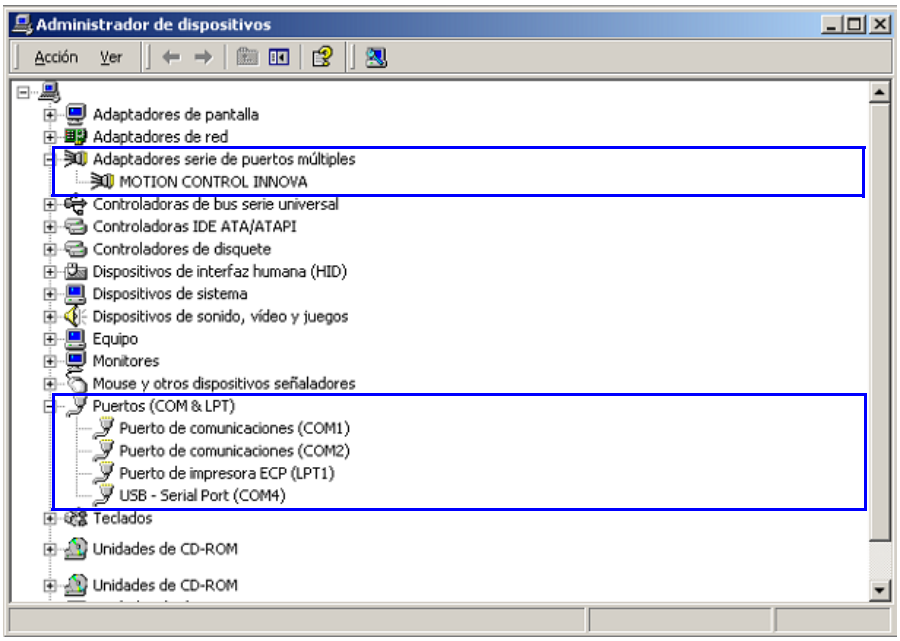
When starting the WinDDSSetup application, you must select the virtual COM port in order establish communication with the unit.

To obtain information on the generated COM port, proceed as follows:

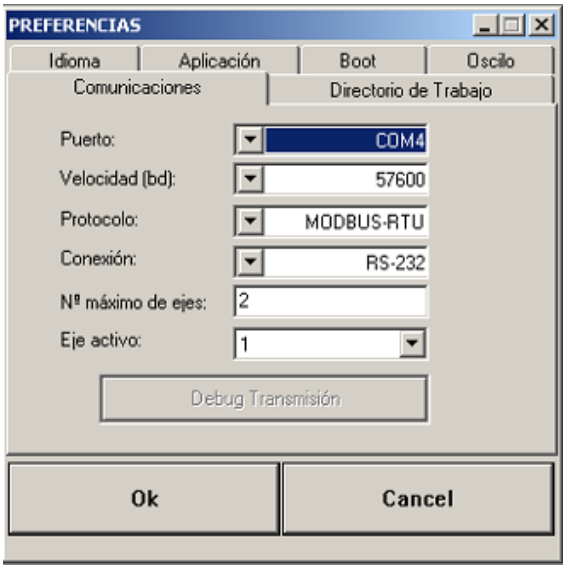
- ☐ Click the right button of the mouse on the icon <My PC>.
- ☐ Select the <Properties> option and the <Hardware> label in the next popup window
- ☐ Now select <Device administrator>.

The window will show them as:

- ☐ **Multiple serial port adapters**, the reference MOTION CONTROL INNOVA
- ☐ **Ports (COM & LPT)**, reference USB-Serial Port (COM**x**). Note that the digit appearing in the x position refers to the new virtual COM port for the PC.



The initialization and adjustment process can **only** be carried out using the PC application WinDDSSetup from its version V0613 on After connecting the USB communication cable between the drive and the PC, the baudrate that must be set in the <preferences> window of the SetUp menu is:



It is also necessary to select the new port that has been generated at the PC (in the drop menu <port>) that, in this example, is COM4.

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

The possible access levels are: Fagor level, user level and 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 > Access level” from the main window of the WinDDSSetup.

Then, if the system consists of an MCPi drive and an FS series motor, its encoder will inform the drive of the type of motor connected to it and will set its parameters automatically to the default values.

However, it might be necessary to adjust the gain of the velocity PI in the application using parameters SP1 (proportional k) and SP2 (integral k) until the desired system performance is achieved.

Any modification done so far in the previous adjustment is stored in the drive's RAM memory, but not permanently. So, all these modifications will be ignored if a reset of the unit is carried out because, when starting up again, the drive assumes the configurations stored in its E^2PROM.

Therefore, to store any modification permanently, the information stored in RAM memory must be transferred into the E^2PROM memory executing the GC1 command. Do a SoftReset (GV11) once the execution of the previous command has finished.

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

Then, execute GC1 and finish the process by resetting the unit.

Note: To restore the parameters to their initial <default> values, execute the command GC10 and then GC1 to store the parameter settings permanently.

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 Innova 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

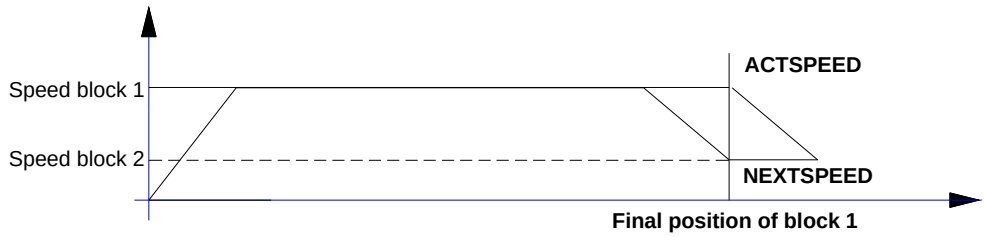
This field determines the feedrate for the movement. This value has no sign. The base units are mm/min (for linear movements) or degrees/min (for rotary movements).

EVENT_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 - Positioning Window -**
IINTPOS	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 - InBandPosition -**. 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.



WARNING: Make sure 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 REG1 - 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 REG2 -ActualPiecesCount- and when this value is equal to REG1-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 # 1 will be located in the motion block address 6010h.

☐ **Full block addressing:**

ModBus address

In decimal: 24576 + (16 · block number)

In hexadecimal: 6010h + (10h · 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 · block number) + Block word number

In hexadecimal: 6010h + (10h · block number h) + block word number h

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 · 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

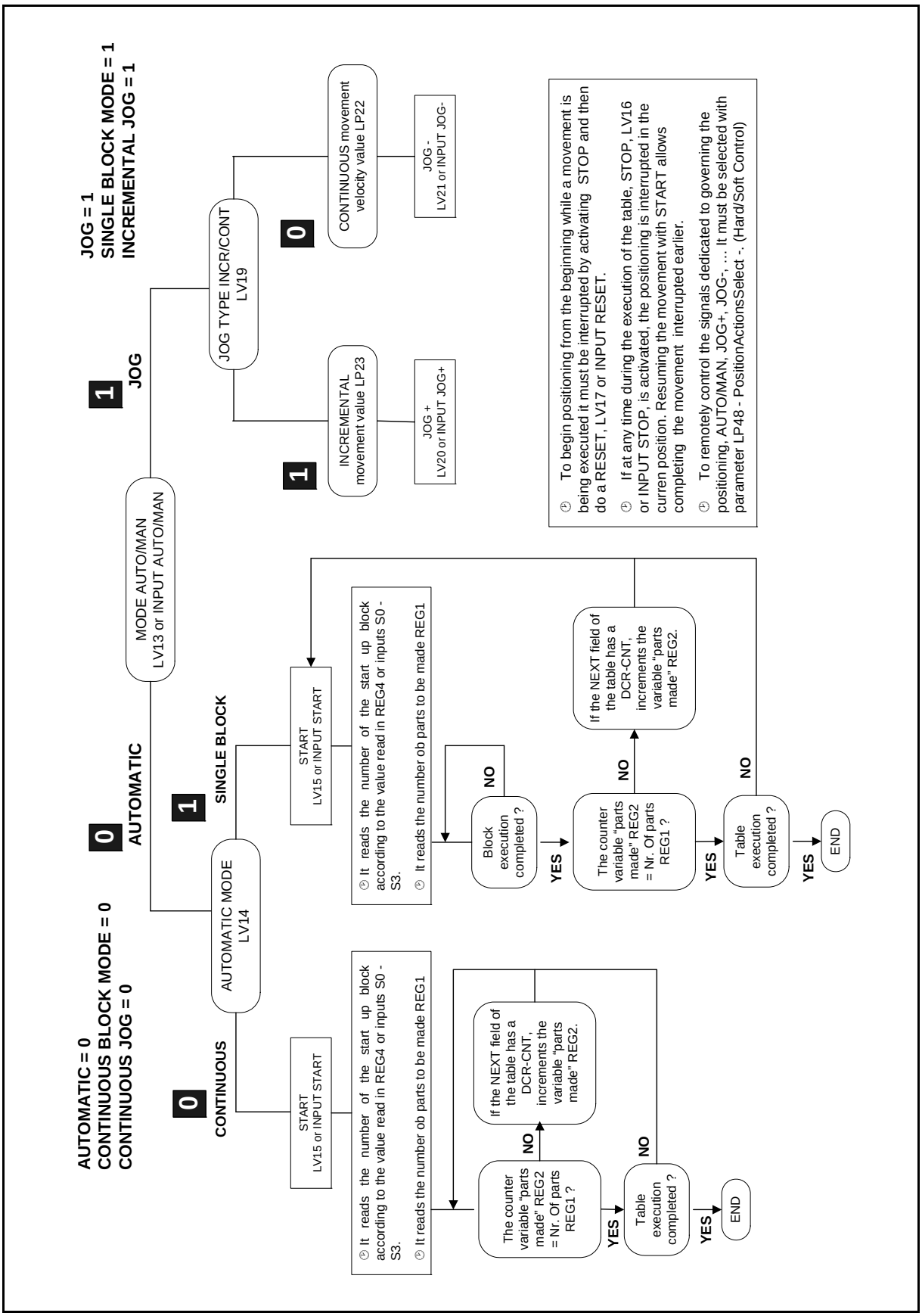
Field description	VELPOS	POSDEST		
		VALUE	MODE	
Value	00000000h to FFFFFFFFh	00000000h to FFFFFFFFh	Absolute	0000 0001 h
			Incremental	0000 0002 h
			+ Infinite	0000 0003 h
			- Infinite	0000 0004 h
			Stop	0000 0005 h
WORD Nr	5-4	3-2	1-0	

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 (REG2), this byte must take a value other than zero. When the parts counter matches the desired number of parts (REG1), 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 MCPi 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. Set 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:

- ☐ **REG4**. PositionBlockIni.
- ☐ **LV15**. KernelStartSignal.
- ☐ **LV16**. KernelStopSignal.
- ☐ **LV17**. KernelResetSignal.
- ☐ **LV13**. KernelOperationMode.
- ☐ **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 OPERATING 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. KernelOperationMode]**.

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 **REG4 - 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 **REG1 - 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 **REG2** is equal to the number of parts-to-be-made given by **REG1**).

□ **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 RESET input, **LV17 - Kernel ResetSignal -** or RESET input.

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:

REG3	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.
REG2	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 GRUP

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 MCSi 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 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 (DigitalInput Function-Selector)" 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 (DigitalInput FunctionSelector)" equal to zero and LP48 (PositionActionsSelect) as control of the feedback change either by software (bit 8) or as 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 will be given in pulses per turn.

NP118 ResolutionOfLinearFeedback

Direct feedback resolution when using a linear encoder. Its value will be given in dµm (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 such as:

☐ whether the home switch is taken into account or ignored.

☐ 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. **IMPORTANT :**When using 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:

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 & 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	Communication	Q
16	Rotor sensor properties	Rotor	R
17	Velocity control loop	Speed	S
18	Torque and power parameters	Torque	T

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

- ☐ **A parameter** defining the system operation (P)
- ☐ **A variable** that can be read and modified dynamically (V) or
- ☐ **A command** that carries out a specific action (C).

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**)
GC1	**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	(**P**) parameter	nr (**10**)	(**basic**) access level

CV11	**Fagor, RO**	▶	**C** group	(**V**) variable	nr (**11**)	(**Fagor**) access level
			(**RO**) read-only variable.			

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.

Examples of a modifiable variable

DV32	**Fagor, RW**	▶	**D** Group	(**V**) variable	nr (**32**)	(**Fagor**) access level
			(**RW**) read-write (modifiable) variable.			

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: **(=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	Function
15, ..., 4	Reserved
3	Programmable input Pins 11 -12 of terminal strip X3 Default value (IP14=4), error reset
2	Drive_OK output Pins 29 -30 of terminal strip X3
1	Speed_Enable input Pin 15 of terminal strip X3
0	Drive_Enable input Pin 13 of terminal strip X3

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

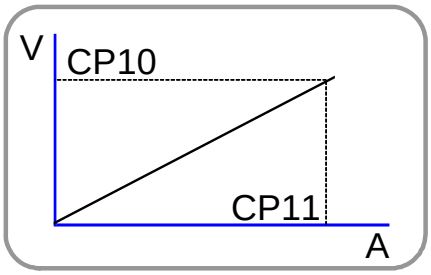
Function: Value of the integral action of the current PI.

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: 9.500 V.

CP11	USER	AmpAmpVolt

Function See parameter CP10.

Valid values: 1.00 ... 50.00 A. Depends on the connected drive.

Default value: MP3 (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: Parameter in charge of enabling / disabling the current filter.

Valid values:

value	function
1	It enables the filter (by default)
0	Disables the filter

CP31	FAGOR	CurrentCommandFilter1Frequency

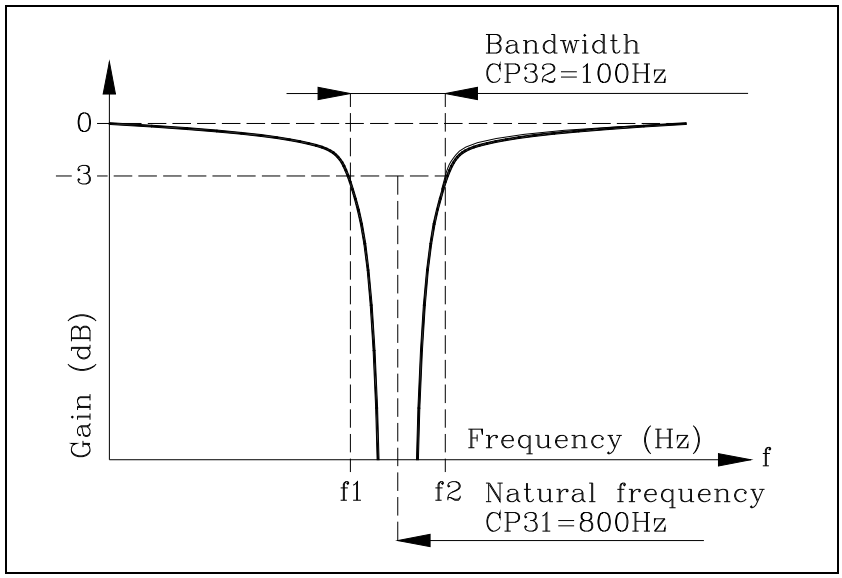
Function: Sets the natural frequency in Hz of a notch filter that acts upon the current command.

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.

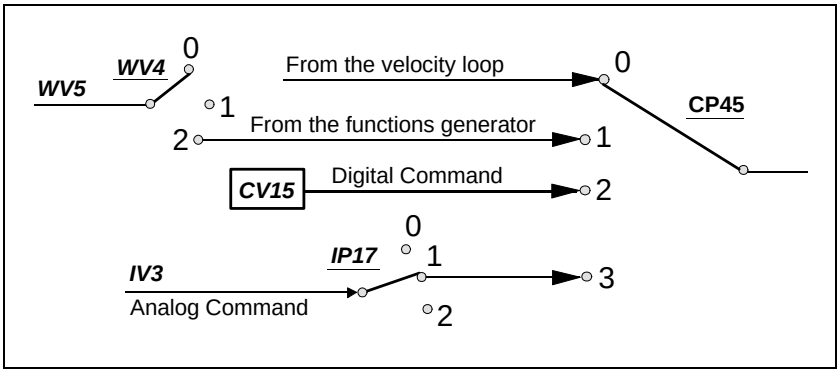
Default value: 0.

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 CV15 that can be modified through the serial line.
3	External analog. It applies the value of the external auxiliary input (pins 17 and 18 of connector X3) 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).

Default value: 0.

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).

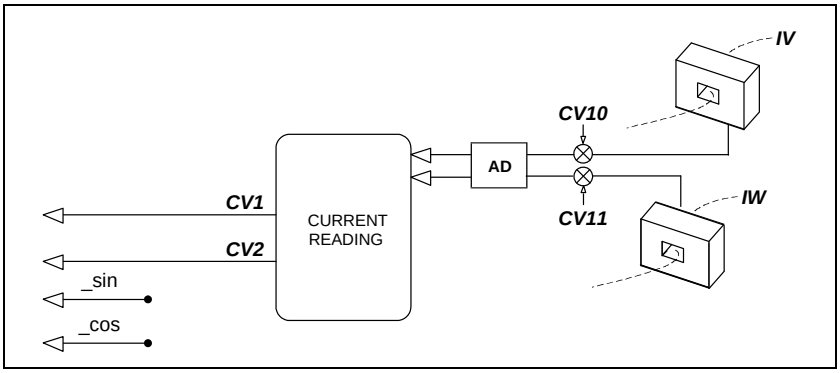
Default value: 0.

CV3	USER, RO	CurrentFeedback

Function: Display the rms current circulating through the motor.

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

Default value: 0.



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).

Default value: 0.

CV11	FAGOR, RO	Current2Offset

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

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

Default value: 0.

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.

DV17	USER, RO	HistoricOfErrors

Function: Stores the last 5 errors that came up at the drive. 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.

DV31	FAGOR, RO	DriveStatusWord

Function: The DV31 variable contains a numerical data coded into 16 binary bits and represents the system status as shown by the attached table. Bits (from the most to the least significant).

Bit	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: The DV32 variable contains a numerical data coded into 16 binary bits and represents the control signals that act upon the drive through the serial line.

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

DV50	FAGOR, RO	ErrorBitArea

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

Error name	Nr on display	Associated bit
Internal_fault	E.001	bit 0
Stop_Time	E.004	bit 1
Temp. driver	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
Reserved	------	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
Param_incompatible	E.502	bit 24

DV51	FAGOR, RO	WarningBitArea

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

Error name	Nr 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 variable 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.

Valid values: 1 ... Number of pulses of the selected feedback.

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.

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 that has been loaded at the drive.

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: Value of the time used in functions OutFunc1 and OutFunc2.

Valid values: 0 ... 9999 ms.

Default value: 2000 ms.

GV2	BASIC, RO	ManufacturerVersion

Function: Displays 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: - 32768 ... 32767. If GV5=27234, the display 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: This variable informs of the drive's sales reference. See section “initialization and adjustment“ in this manual.

GV11	BASIC, RW	SoftReset

Function: Variable that 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 numbers active in the unit.

Valid values: 0 ... 999.

GC1	BÁSICO	BackupWorkingMemoryCommand

Function: Command to execute the parameter transfer from RAM to E^2PROM.

GC10	BASIC	LoadDefaultsCommand

Function: Command to initialize parameters. This command loads the default parameters of the drive for the motor whose ID is stored in parameter MP1. See section “initialization and adjustment“ in this manual.

H group. Hardware

HV5	BASIC, RO	PLDVersion

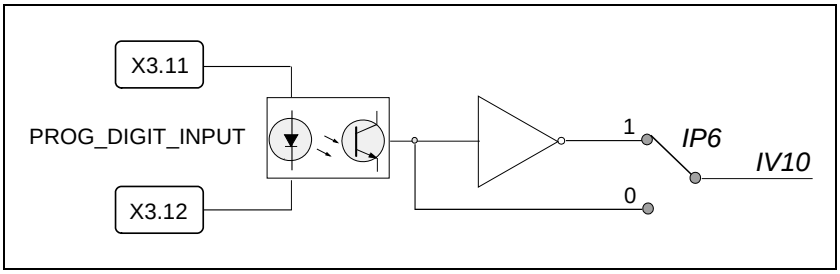
Function: Software version installed in the unit's PLD's

I group. Inputs

IP6	USER	DigitalInputPolarity

Function: Sets the polarity (inverted or not inverted) of the programmable input (pins 11 and 12 of X3).

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 11 and 12 of X3) is configured as remote input for resetting errors (IP14=04).

Valid values: 0 ... 4.

Value	Function	Description
0	missing	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
1	InFunc1	Reset of the integral action of the velocity loop
2	InFunc2	Invert the velocity command
3	InFunc3	Halt function (drive management)
4	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.

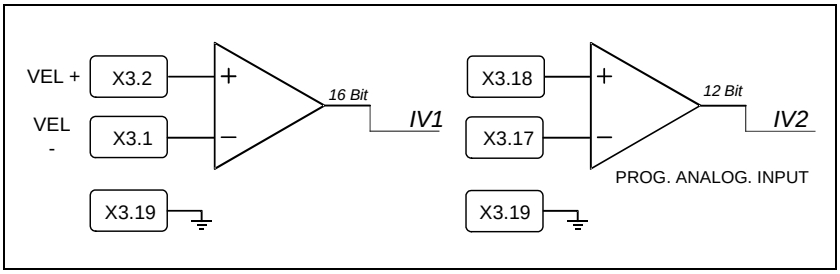
Valid values: 0 (by default) ... 2.

IV3 as input
to function Nr ►►►

IP17	Function
00	missing
01	Func1
02	Func2

IV1	BASIC, RO	AnalogInput1

Function: Monitors the voltage through the analog input ANALOG VELOCITY COMMAND INPUT (VEL+ and VEL-) (pins 2-1 of X3). It's display is in volts.



IV2	USER, RO	AnalogInput2

Function: Monitors the input voltage through analog input 2 (pins 18 - 17 X3). It's display is in volts.

IV3	USER, RO	CurrentCommandAfterScaling

Function: Contains the value of the auxiliary analog command (pins 17 and 18 of X3; 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.

Default value: 0.00.

IV10	USER, RO	DigitalInputs

Function: This variable reflects the status of the programmable digital input at pins 11 and 12 of connector X3. The status of this variable is affected by IP6.

Valid values: 0 (by default) and 1.

IV11	USER, RO	DigitalInputCh2

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.

KV10	USER, RO	CoolingTemperature

Function: It displays the temperature of the heatsink of the power stage.

Valid values: 0 ... 200 ° C.

KV32	USER, RO	$I^2tDrive$

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 %.

Default value: 0 %.

KV36	USER, RO	$I^2tMotor$

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 %.

Default value: 0 %.

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 causes error E.314.

Valid values: 0 ... 100 %.

Default value: 0 %.

KV41	USER, RW	BallastSelect

Function: Selector that determines whether the ballast resistor is external or internal.

Valid values: 0/1. External / Internal (by default).

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 ... 214748 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] ☑	1 [soft] ☑	1 [soft] ☑	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			

(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 DeviceNetTM or ProfibusTM field bus as communication interface.

LP48.13 = 0 The unit has a CAN DeviceNetTM or ProfibusTM 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 DeviceNetTM or ProfibusTM 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 (by default) ... 214748

LP115 USER	EnableBatteryLowWarning

Function: This parameter is used to activate or deactivate battery charge monitoring in applications that use absolute encoders with battery.

See warning **E.820.**

Valid values: 0/1. monitoring off / monitoring on.

Default value: 0. monitoring off.

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	Function
15 (MSB), ..., 2 (reserved)	
1, 0 (LSB)	(0,0) Clockwise rotation (0,1) Counterclockwise rotation (1,0) Rotation via the shortest path (by default) (1,1) Reserved

Valid values: 0, 1 and 2 (default value).

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 - KernelStart Signal -** .

LV19	FAGOR, RW	KernelManMode

Function: It indicates 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: Variable that 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: -214748 ... 214748 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: -214748 ... 214748 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 ... 214748 (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 ... 214748 m/min.

Default value: 0.

LV160 FAGOR, RW	PositioningAcceleration

Function: Maximum acceleration applied to all the positioning blocks (in module).

Valid values: 0 ... 65535 mm/s^2.

Default value: 20 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/s^2.

Default value: 20 mm/s^2.

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 - TargetPosition -** .

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.

MP2	FAGOR	MotorTorqueConstant

Function: Contains the torque constant of the synchronous motor, (motor torque according to the rms current)

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

Default value: It depends on the motor connected.

MP3	FAGOR	MotorContinuousStallCurrent

Function: Contains the 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: It depends on the motor connected.

MP4	FAGOR	MotorPeakCurrent

Function. Peak current of the motor. This current value must NEVER be exceeded in the motor. See parameter CP20.

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

Default value: It depends on the motor connected.

N group. Linear axis configuration

NP117	FAGOR	ResolutionOfFeedback2

Function: It indicates the 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 ... 65535.

Default value: 4096 pulses per turn (ppt) of the rotary encoder.

NP118 FAGOR	ResolutionOfLinearFeedback

Function: It indicates the 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 of this parameter 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 mµ, that is:

NP118=100

If a x5 multiplying factor is applied to a Fagor linear encoder COVX (20 mµ), 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: They define 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**.
It must be set to this value so the direct feedback is properly defined.
- If **NP133** it must be set to zero.
It assumes the value given in **NP123** as the leadscrew pitch.

Valid values: 0 ... 214768 mm.

Default value: 5 mm.

Example 1.

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 2.

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

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 31 of X3) and channel 2 (pin 32 of X3).

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

Default value: 04 for OP1 and 07 for OP2.

OP1	VAR.	NAME	OP2	VAR.	UNITS
00	SV15	DigitalVelocityCommand	00	SV15	rev/min
01	SV1	VelocityCommand	01	SV1	
02	SV6	VelocityCommandAfterFilters	02	SV6	
03	SV7	VelocityCommandFinal	03	SV7	
04	SV2	VelocityFeedback	04	SV2	
05	TV1	TorqueCommand	05	TV1	dN·m
06	TV2	TorqueFeedback	06	TV2	
07	CV3	CurrentFeedback	07	CV3	cA
08	WV5	GeneratorOutput	08	WV5	-------
09	IV1	AnalogInput1	09	IV1	mV
10	IV2	AnalogInput2	10	IV2	
11	PV189	FollowingError	11	PV189	dµm or m°

OP3	**USER**	**DA1ValuePer10Volt**

OP4	**USER**	**DA2ValuePer10Volt**

Function: They define the gain of channel 1 (pin 31 of X3) and channel 2 (pin 32 of X3). There are 10 V at these outputs when the selected variable reaches this value.

Units: The units of the variable being displayed.

Valid values: 0 ... 9999.

Default value: 4000 and 3000 respectively.

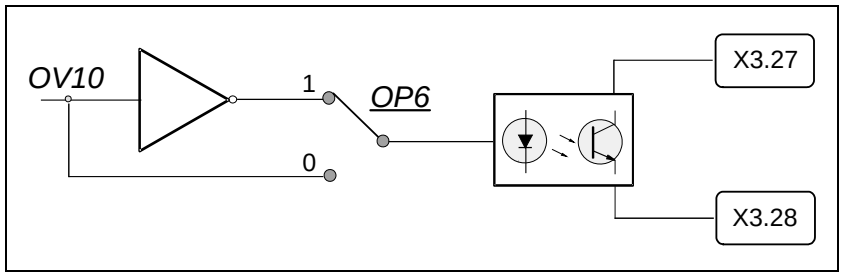
Example.

Sea OP1=04 [SV2] (VelocityFeedback), in rev/min and OP3=3000. **Meaning:** 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 ±10V.

OP6	**USER**	**DigitalOutputPolarity**

Function: Sets the polarity (inverted or not inverted) of the programmable digital input (pins 27 and 28 of X3).

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



OP14	**USER**	**DigitalOutputFunctionSelector**

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

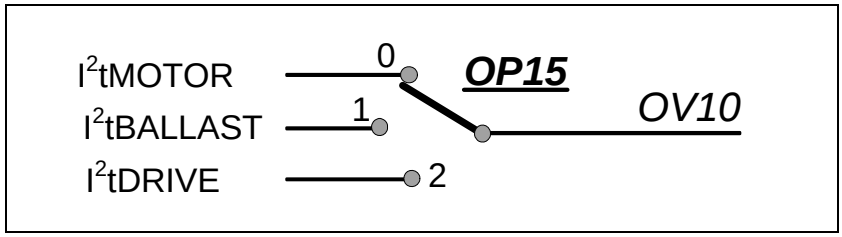
OP14	**Function**
00	OutFunc0
01	OutFunc1
02	OutFunc2
03	OutFunc3
04	OutFunc4
05	OutFunc5
06	OutFunc6
07	OutFunc7

◄◄◄ **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. $I^2tMotor$ (by default)
1. $I^2tBallast$.
2. $I^2tDriver$.



OV10	USER, RO	DigitalOutputs

Function: The OV10 variable contains the value of the output status of the various functions that may be selected with OP14.

Valid values: 0 (by default) and 1.

OV11	USER, RO	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 X11).

LP48.bit 12 = 1 ➔ OV11 governs the status of the digital outputs (connector X11).

See parameter LP48 for further detail.

P group. Position loop

PP1	FAGOR	HomingVelocitySlow

Function: It is the slow speed of the homing process controlled from the drive itself. This parameter is necessary when the homing search is controlled from the drive: **PC148 - DriveControlled Homing -** activo.

Valid values: 0 ... 6000 rev/min of the motor.

Default value: 100 rev/min of the motor.

PP41	FAGOR	HomingVelocityFast

Function: It is the fast speed of the homing process controlled from the drive itself. This parameter is necessary when the homing search is controlled from the drive: **PC148 - Drive ControlledHoming -** activo.

Valid values: 0 ... 6000 rev/min of the motor.

Default value: 200 rev/min of the motor.

PP42	FAGOR	HomingAcceleration

Function: It is the acceleration applied in the homing process controlled from the drive itself. This parameter is necessary when the homing search is controlled from the drive: **PC148 - Drive ControlledHoming -** active.

Valid values: 0 ... 65535 rad/s^2.

Default value: 20 rad/s^2.

PP49	FAGOR	PositivePositionLimit

PP50	FAGOR	NegativePositionLimit

Function: They delimit the area permitted for the movements of the axis. 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).

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).

If the **LV158 - TargetPosition -** variable exceeds the position limits, the drive activates bit 13 (TargetPosition OutsideTheTravelZone) of **DV158 - Class2Diagnostics (Warnings) -.**

Valid values: - 214748 ... 214 748 mm.

Default value: 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 describes 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 describes 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.

Bear in mind that on rotary motors, if the sign of the position command variations is positive, the motor will turn clockwise.

Bit Nr	Meaning
15 (MSB), 14, 13, 12, 11, 10, 9, 8, 7, 6, 5	reserved
4	Position limits. = 0 Cancels the position limits = 1 Activates the position limits (by default). See parameters PP49 and PP50.
3, 2, 1	Reserved
0 (LSB)	Sign of the position command value. = 0 Not inverted = 1 Inverted (by default)

PP57 FAGOR	**PositionWindow**

Function: It indicates 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: -214 748 ... 214 748 mm for linear axes and (°) for rotary axes.

Default value: 2 mm for linear and (°) 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), 14, 13, 12, 11, 10, 9, 8 (reserved, all = 0).	
7	Format. = 0 Absolute (by default). = 1 Module. See parameter PP103.
6, 5, 4, 3, 2 (reserved).	
1, 0 (LSB)	Position command scaling method. = 01 Linear scaling (by default). = 10 Rotary scaling.

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°

Default value: 360° (since it is usually 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 ... 65535 (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).

Example.

See the previous example.

PP115 FAGOR	PositionFeedback2Type

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

Bit Nr	Meaning
15 (MSB), 14, 13, 12, 11, 10, 9, 8, 7, 6, 4	(Reserved)
3	Feedback direction. = 0 Not inverted. = 1 Inverted.
2, 1	Reserved
0 (LSB)	Feedback type. = 0 Rotary. See parameter NP117. = 1 Linear.

PP147 FAGOR	HomingParameter

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.

See the following table.

Bit Nr	Meaning
15 (MSB), 14, 13, 12, 11, 10, 9, 8	reserved
7	Position after the drive controlled homing procedure. (Reserved).
6	Evaluation of the reference mark (I0). = 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 used = 0 Feedback on the motor. (By default). = 1 Direct feedback.
2	Home switch connection. (Reserved).
1	Home switch signal logic (H-S notation). = 0 Pressing the H-S sets the PLC input to 1. + logic (By default). = 1 Pressing the H-S 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 this is greater than the value given by **PP159**, the drive issues **E.156** (too much following error). If this parameter is set to “0”, the following error will not be monitored.

It is important to set it 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.

Valid values: 0 ... 214748 mm on linear movements

0 ... 214748 degrees for rotary movements

If **PP159 = 0**, the following error will not be monitored.

Default value: 3 mm (for linear movements).

3 degrees (for rotary movements).

PP216	FAGOR	VelocityFeedForwardPercentage

Function: It sets the how much velocity feed-forward is 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 how much velocity feed-forward is 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: - 214748 ... 214748 mm for linear axes & (°) for 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 and through the direct feedback.

Valid values: - 214748 ... 214748 mm for linear axes & (°) for 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: - 214748 ... 214748 mm for linear axes & (°) for 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: dµm 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 off.
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 is all hardware but the IP14 value is other than zero. See parameter LP48.
- ☐ The control of the digital inputs is individual, but bit 8 is set to "1" (control by software). See parameter LP48.

Q group. Communication

QP16	USER	SerialSettings

Function: Determines the communications parameters of the UART (Universal Asynchronous Receiver/Transmitter) of the 485 serial line of connector X1.

For the service line USB-COM, it is always configured as (57600, no parity, 8 data bits, 1 stop bit).

Bit	Function
15, ..., 12	Reserved
11, 10	Stop bits **1** Stop bits **2** Stop bit
9, ..., 6	Data bits **7** Data bits **8** Data bits
5, 4	Parity bits **0** No parity **1** Even parity **2** Odd parity
3, ..., 0	Communication speed (baudrate) **0** 2400 Bd **1** 3600 Bd **2** 4800 Bd **3** 7200 Bd **4** 9600 Bd **5** 19200 Bd **6** 38400 Bd **7** 57600 Bd **8** 115200 Bd

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

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 (the WinDDSSetup shows the parameter names directly).

Valid values: Any parameter bus identifier.

Default value: 0.

QV96 USER, RW SlaveArrangement

Function: This variable contains the number of the node assigned to the drive for communication.

Valid values: 0 ... 127.

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

Default value: 0.

S group. Velocity

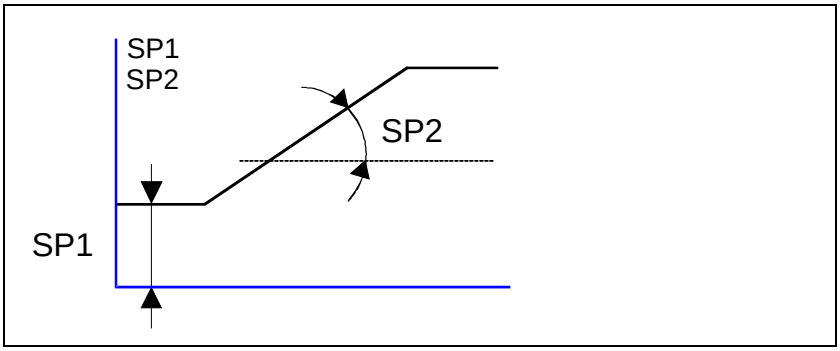
SP1	BASIC	VelocityProportionalGain

SP2	BASIC	VelocityIntegralGain

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

Valid values: SP1: 0.0 ... 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 ... 9999.

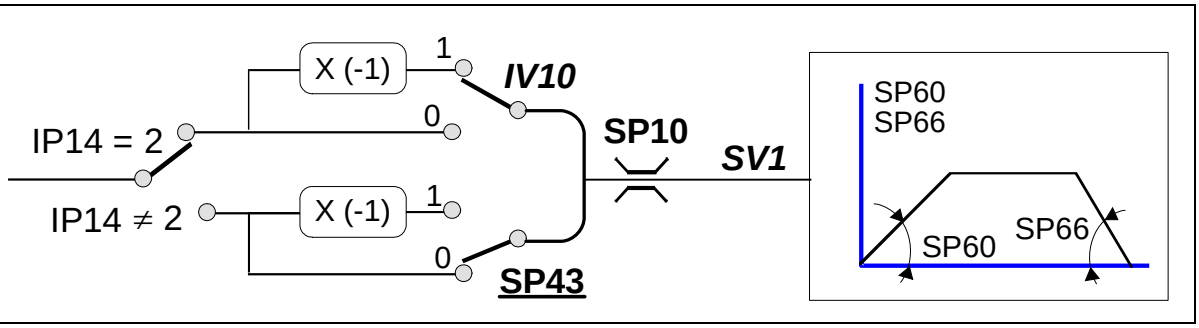
Default value: SP1: 0.

SP10	BASIC	VelocityLimit

Function: Maximum velocity limit for the SV7 variable (Velocity CommandFinal).

Valid values: 0 ... 110 % of the motor rated speed in rev/min.

Default value: 1000 rev/min.



SP19	BASIC	SymmetryCorrection

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

Valid values: - 500 ... + 500 mV.

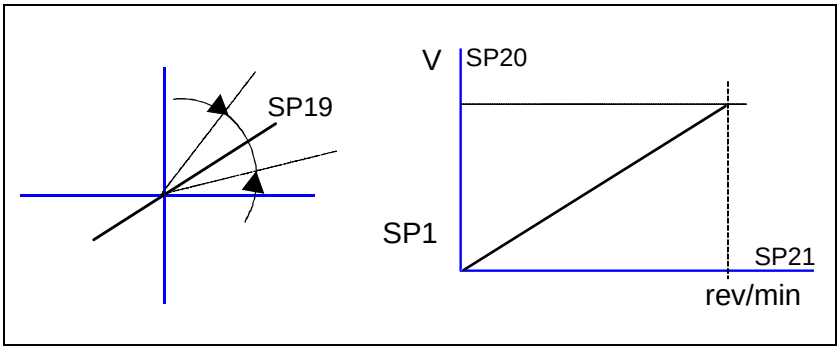
Default value: 0 mV.

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: 9.50 V.



SP21	BASIC	RpmRpmVolt

Function: See parameter SP20.

Valid values: 10 ... Motor rated speed (rev/min).

Default value: Motor rated speed (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)/100.

Default value: 0 (rev/min)/100.

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 (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 (SV2) has reached the supplied command (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: Determines the value of the velocity window around zero that will be considered to be zero speed.

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

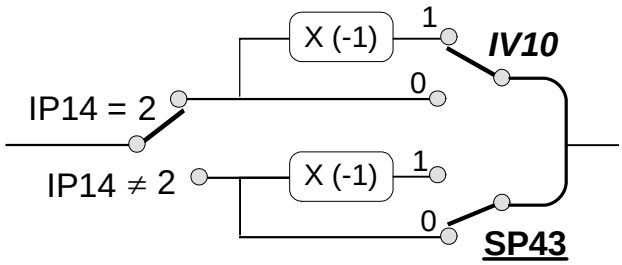
Default value: 20 rev/min.

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 runaway).

Valid values: 0/1. Not inverted / Inverted.

Default value: 0. Not inverted.



SP45	BASIC	VelocityCommandSelector

Function: This parameter is used to determine the velocity command source.

Valid values: 0 ... 2.

value	function
0	Analog. Input through pins 1 and 2 of connector X3 after being adapted by SP19, SP20 and SP21.
1	Reserved.
2	Digital. Value of SV15.

Default value: 0.

SP60	BASIC	VelocityAccelerationTime

Function: Determines the value of the acceleration ramp applied to the velocity command. Setting this parameter with a 0 value means that no ramps will be applied.

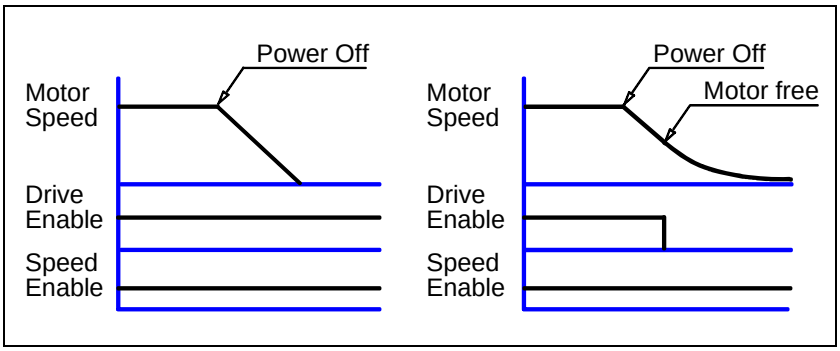
Valid values: 0.0 ... 400.0 (rpm)/ms.

Default value: 0.

SP65	BASIC	EmergencyAcceleration

Function: In 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 stops with the emergency ramp until its speed is zero as long as the mechanical energy stored in the motor allows it. Therefore, it limits 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 (rpm)/ms.

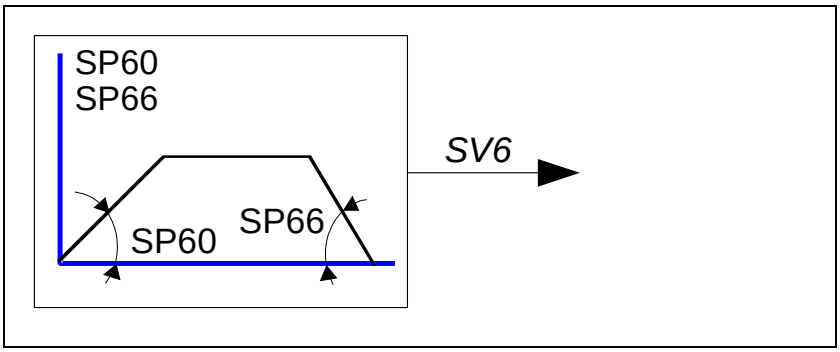
Default value: 0.0.

SP66	BASIC	VelocityDecelerationTime

Function: They set the value of the acceleration and deceleration ramps applied to the velocity command. Setting these parameters with a 0 value means that no ramps will be applied.

Valid values: 0.0 ... 400.0 (rev/min) / ms.

Default value: 0.



SV1	BASIC, RW	VelocityCommand

Function: Velocity command after the SP45 selector.

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

Default value: 0.

SV2	BASIC, RO	VelocityFeedback

Function: Velocity feedback.

Valid values: - 9999 ... + 9999 rev/min.

SV6	BASIC, RO	VelocityCommandAfterFilters

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

Valid values: - 9999, ..., + 9999 rev/min.

SV7	BASIC, RO	VelocityCommandFinal

Function: Final velocity command applied to the loop.

Valid values: - 9999 ... + 9999 rev/min.

SV15	USER, RW	DigitalVelocityCommand

Function: Digital velocity command.

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

T group. Torque and power

TP1	USER	TorqueThresholdTx

Function: Parameter that determines the threshold for the activation of OV10 when function OutFunc2 (TorqueLimitModeZero Search) is activated.

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

Valid values: 0 ... 100 %.

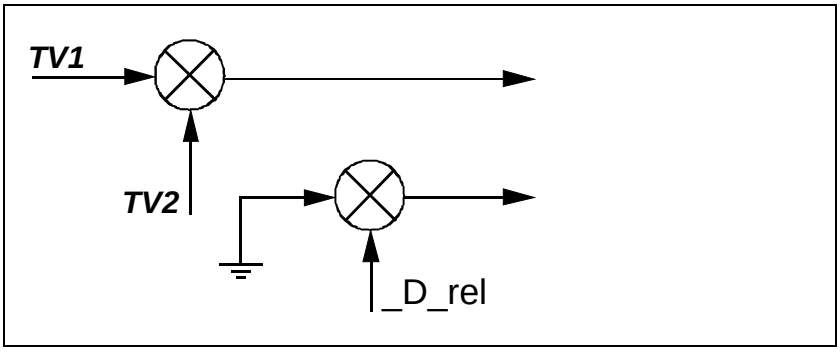
Default value: 5 %.

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..



W group. Internal generator

WV1	USER, RW	GeneratorShape

Function: It indicates the waveform of the internal command generator.

Valid values:

Value	Waveform
0	Sinusoidal
1	Square
2	Triangular

Default value: 1.

WV2	USER, RW	GeneratorPeriod

Function: It indicates the signal period of the internal command generator.

Valid values: 2 ... 9999 ms.

Default value: 200 ms.

WV3	USER, RW	GeneratorAmplitude

Function: Signal amplitude of the internal command generator.

Valid values: 0 ... 9999 rev/min if it is a velocity command.

0 ... 9999 Arms/100 if it is a current command.

Default value: 0.

WV4	USER, RW	GeneratorType

Function: It specifies on which magnitude the internal command is applied.

Valid values:

Value	Waveform
0	Generated disconnected (by default)
1	Generated connected. Velocity command
2	Generated connected. Current command

Default value: 0.

WV5	USER, RO	GeneratorOutput

Function: Variable that reflects the value of the signal generated by the internal function generator.

Valid values: - 9999 ... 9999.

Default value: 0.

WV6	USER, RW	GeneratorDutyCycle

Function: For generating square signals (WV1=1), this variable specifies the ratio of the duty cycle.
For example: to simulate an S6-40 % cycle, WV6=40.

Valid values: 1 ... 99 %.

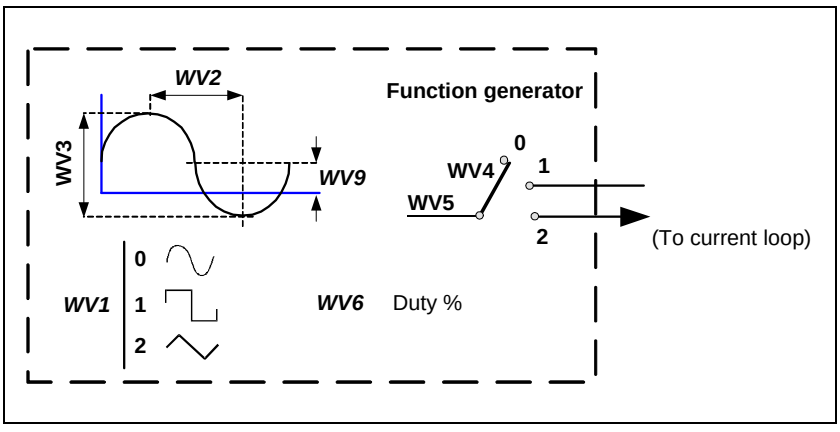
Default value: 50 %.

WV9	USER, RW	GeneratorOffset

Function: It allows entering an offset in the signal of the internal command generator.

Valid values: - 9999 ... + 9999 rev/min. Velocity.

- 9999 ... + 9999 Arms/100. Current.



DEDICATED PLC REGISTERS

NOTATION USED

[REG] [Index] where:

REG:	Character identifying the dedicated PLC register.
Index:	Register identifier number

There are the following registers:

REG1	**USER, RW**	**PiecesCount**

Function:	Counter for the number of parts to be made.
Valid values:	0 ... 65535 - Nr of parts -.
Default value:	0.

REG2	**USER, RW**	**ActualPiecesCount**

Function:	Counter for the number of parts that have been made so far.
Valid values:	0 ... 65535 - Nr of parts -.
Default value:	0.

REG3	**USER, RW**	**RunningBlock**

Function:	Register that reflects the number of the block being executed.
Valid values:	1 ... 127.
Default value:	1.

REG4	**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 ModBus protocol with any device acting as **MASTER** like, for example, an ESA video terminal.

ERROR MESSAGES

E.001	Internal	E.001

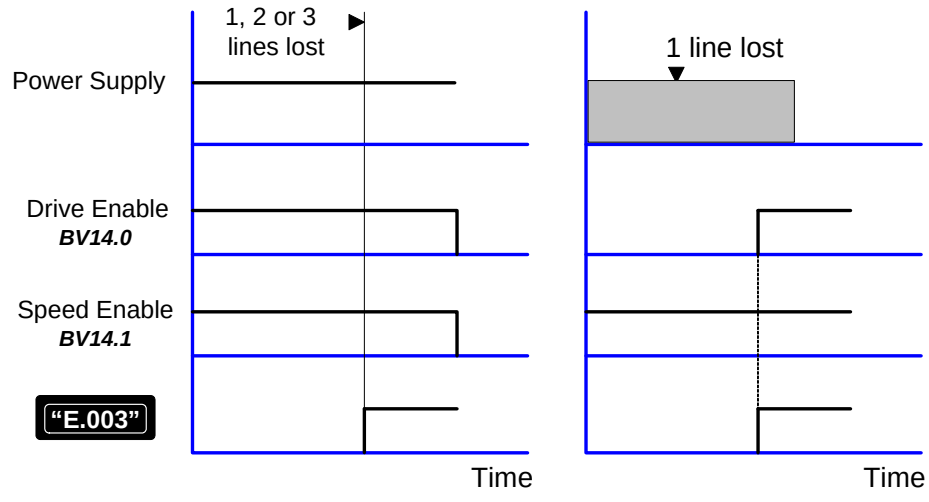
Contact Fagor Automation.

E.003	Error at the power bus voltage	E.003

Probably, one of the three-phase lines has dropped because of the torque.

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.

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	E.004

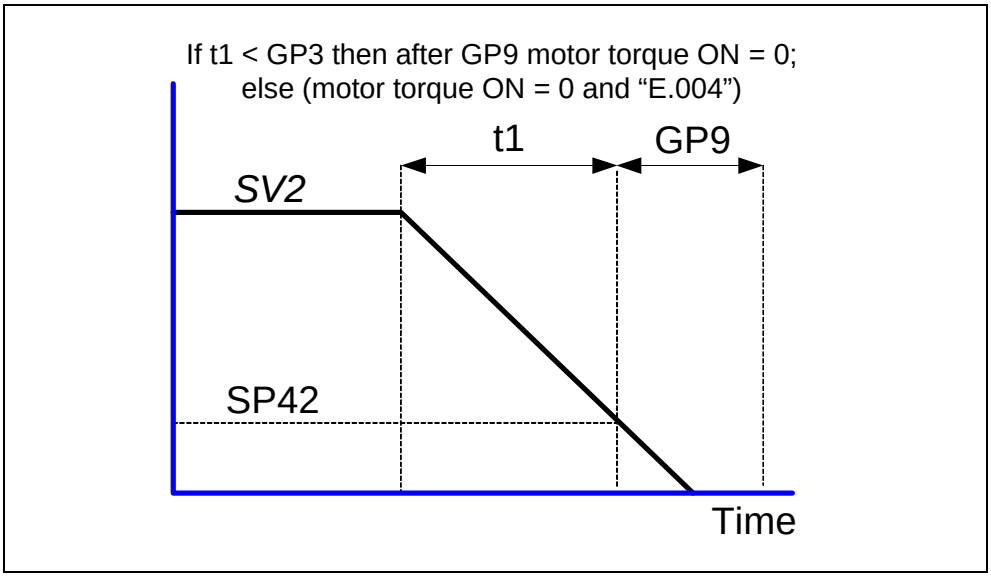
An attempt has been made to stop the motor by canceling **Speed Enable**. The system has tried to stop the motor at full torque, but it has not been able to stop it in the time frame set by parameter GP3 (**StoppingTimeout** = maximum time allowed for braking, before considering the error for being unable to stop it in the set time) or the parameter that deterrmines 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.

Solutions

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 ofthis 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)	E. 106

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

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

E.108	Motor overheated	E. 108

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.

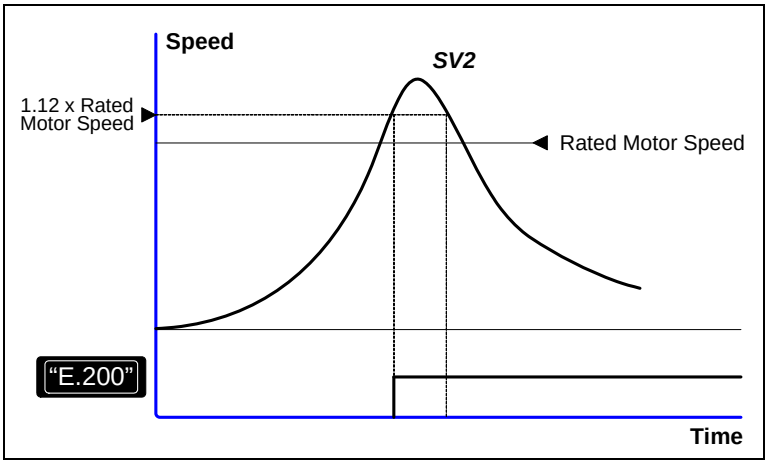
Stop the system for several minutes and decrease the effort demanded from the drive. Cool the motor.

E.156	Following error	E. 156

Too much following error has been generated.

E.200 Overspeed

E.200



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

Bad cabling of the position sensor or of the motor power.

The velocity loop is adjusted wrong.

Decrease the speed overshoot in the system response.

E.201 Motor overload

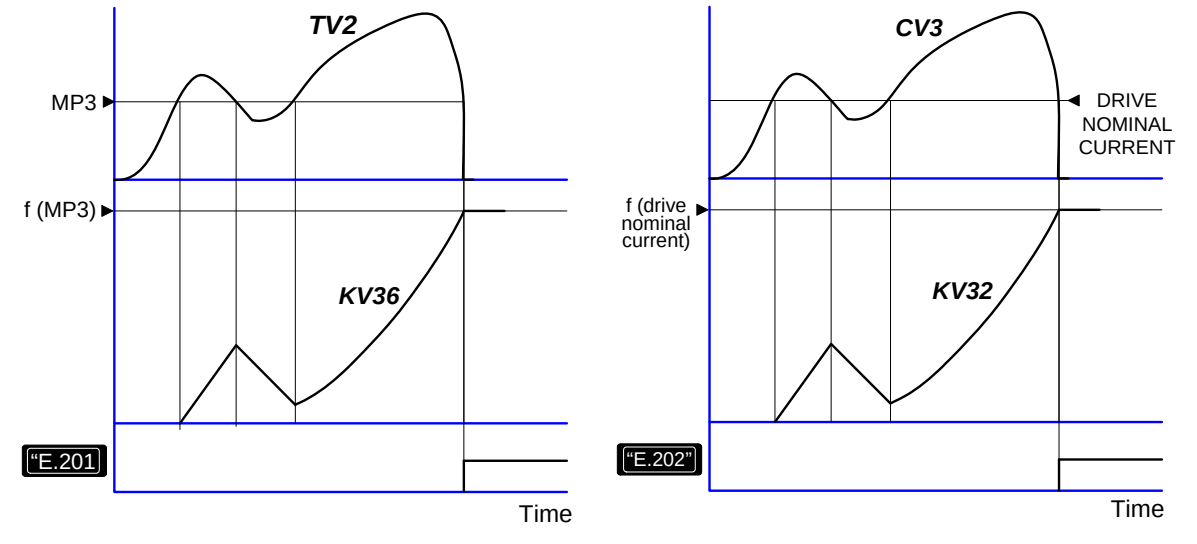
E.201

E.202 Drive overload

E.202

The I^2t protection of the drive went off. The duty cycle is greater than the system can provide.

Decrease the speed overshoot in the system response.



E.214 Short-circuit

There is short-circuit at the drive module.

Reset the error.

If it persists, may be because:

- ☐ An erroneous sequence when connecting the power cables or a short-circuit between them.
- ☐ The parameters may be wrong or there is a fault at the drive.

Contact Fagor Automation.

After displaying E.214, it will display some of the codes that describe the type of short-circuit that has taken place.

ABS	over the absolute value of the output current
IGBT	at the IGBT's
OUT	in the output

E.304 Power bus voltage too high

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

When using an external Ballast, it is not connected properly. The Ballast resistor is burned.

Disconnect the power supply and ckeck the proper connection of the Ballast circuit.

E.307 Power bus voltage too low

The mains voltage is too low.

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

E.314 Ballast overload

Due to the duty cycle, the Ballast resistor is overloaded.

Resize the Ballast resistor.

Decrease the duty cycle.

Smooth the duty cycle by applying acceleration ramps.

E.502	Incompatible parameters	

Parameter incompatibility.

Example.

Let us assume a drive that controls a 4000 rev/min motor with its parameters set (e.g.: speed limit SP10=4400). If now, a 2000 rev/min motor is connected, the speed limit will be beyond the value allowed for this new motor. The RAM memory will then be readjusted and error E.502 will be issued indicating the wrong parameters in the QV22 variable.

If the unit is reset without having saved the parameters, the error will come up again. It will disappear when the parameters (readjusted in RAM memory by the drive) are saved into EEPROM memory using the GC1 command.

E.506	Motor table missing	

Contact Fagor Automation.

E.510	Motor not accepted	

The drive does not accept the motor that has been connected to it.

E.801	Encoder not detected	

The drive has not detected the sensor.

Check the cabling and the motor connection regarding connector X2. Then do a reset.

If it doesn't fix it, contact Fagor Automation.

E.802	Defective encoder	

Communication error. After an initial connection, communication errors keep coming up.

Check the cabling and the motor connection regarding connector X2. Then do a reset.

If it doesn't fix it, contact Fagor Automation.

E.803	Encoder not initialized	

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 E.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.
- **Warning E.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 E.820.** Absolute econder battery too low. Replace battery.
- **Warning E.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 E.917.** "Software travel limit approaching" warning. This indication indicates that it is getting close to the that limit.

LIST OF PARAMETERS, VARIABLES AND COMMANDS. IDs ModBus

Mnem.	Name	Level	IdBus	Acc	Min.	Max.	Def.	Units	Page
AP1	PrimaryOperationMode	Fagor	65	rw	2	5	3	-----	62
BV14	NotProgrammableIOs	Fagor	8601	ro	0	65535	-----	-----	62
CP1	CurrentProportionalGain	Fagor	213	rw	0	999	-----	-----	63
CP2	CurrentIntegralTime	Fagor	215	rw	0	999	-----	-----	63
CP10	VoltageAmpVolt	User	8823	rw	1000	9999	9500	mV	63
CP11	AmpAmpVolt	User	8825	rw	100	5000	5000	cA	63
CP20	CurrentLimit	Basic	8807	rw	0	5000	0	cA	63
CP30	CurrentCommandFilter1Type	Fagor	8809	rw	0	1	0	-----	64
CP31	CurrentCommandFilter1Frequency	Fagor	8817	rw	0	4000	0	Hz	64
CP32	CurrentCommandFilter1Damping	Fagor	8819	rw	0	1000	0	Hz	64
CP45	CurrentCommandSelector	User	8821	rw	0	3	0	-----	65
CV1	Current1Feedback	User	8811	ro	-5000	5000	-----	cA	65
CV2	Current2Feedback	User	8813	ro	-5000	5000	-----	cA	65
CV3	CurrentFeedback	User	8815	ro	-5000	5000	-----	cA	66
CV10	Current1Offset	Fagor	8803	ro	-2000	2000	-----	mA	66
CV11	Current2Offset	Fagor	8805	ro	-2000	2000	-----	mA	66
CV15	DigitalCurrentCommand	User	8827	rw	-5000	5000	0	cA	66
DC1	ResetClass1Diagnostics	User	199	rw	0	15	0	-----	69
DC2	ClearHistoricOfErrorsCommand	User	8997	rw	0	15	0	-----	69
DV17	HistoricOfErrors	User	9012	ro	-----	-----	-----	-----	67
DV31	DriverStatusWord	Fagor	271	ro	0	65535	-----	-----	67
DV32	MasterControlWord	Fagor	269	rw	0	65535	0	-----	67
DV50	ErrorBitArea	Fagor	2456	ro	-----	-----	-----	-----	68
DV51	WarningBitArea	Fagor	2457	ro	-----	-----	-----	-----	69
EP1	EncoderSimulatorPulsesPerTurn	Basic	9193	rw	1	pulses	---	-----	69
EP3	EncoderSimulatorDirection	Basic	9197	rw	0	1	0	-----	69
GC1	BackupWorkingMemoryCommand	Basic	529	rw	0	15	0	-----	71
GC10	LoadDefaultsCommand	Basic	525	rw	0	15	0	-----	71
GP3	StoppingTimeout	Basic	9597	rw	0	9999	500	ms	70
GP5	ParameterVersion	Basic	9601	ro	----	----	----	-----	70
GP9	DriveOffDelayTime	Basic	415	rw	0	9999	50	ms	70
GP11	IOFunctionsTime	User	9645	rw	0	9999	2000	ms	70
GV2	ManufacturerVersion	Basic	60	ro	----	----	----	-----	70
GV5	CodeChecksum	Basic	9605	ro	----	----	----	-----	70
GV7	Password	Basic	535	rw	0	9999	0	-----	71
GV9	DriveType	Basic	280	ro	----	----	----	-----	71
GV11	SoftReset	Basic	9609	rw	0	16	0	-----	71
GV16	MotorTableVersion	Basic	9625	ro	----	----	----	-----	71
GV75	ErrorList	Fagor	750	ro	----	----	----	-----	71

Mnem.	Name	Level	IdBus	Acc	Min.	Max.	Def.	Units	Page
HV5	PLDVersion	Basic	8783	ro	----	----	----	-----	72
IP6	DigitalInputPolarity	User	1001	rw	0	1	0	-----	72
IP14	DigitalInputFunctionSelector	User	1001	rw	0	4	4	-----	72
IP17	AnalogFunctionSelector	User	1001	rw	0	2	0	-----	73
IV1	AnalogInput1	Basic	1000	ro	-12000	12000	----	mV	73
IV2	AnalogInput2	User	1000	ro	-1200	1200	----	cV	73
IV3	CurrentCommandAfterScaling	User	1001	ro	-9999	9999	----	cA	73
IV10	DigitalInputs	User	1000	ro	0	1	----	-----	73
IV11	DigitalInputsCh2	User	1000	ro	0	65535	0	---	73
KP3	ExtBallastPower	User	1042	rw	200	2000	200	W	74
KP4	ExtBallastEnergyPulse	User	1042	rw	200	2000	200	J	74
KV10	CoolingTemperature	User	1039	ro	-20	200	----	° C	74
KV32	I2tDrive	User	1041	ro	0	100	----	%	74
KV36	I2tMotor	User	1041	ro	0	100	----	%	74
KV40	I2tCrowbar	User	1042	ro	0	100	----	%	74
KV41	BallastSelect	User	1042	rw	0	1	1	-----	74
LP22	JogVelocity	Fagor	1283	rw	0	50000	1000	mm/min	75
LP23	JogIncrementalPosition	Fagor	1283	rw	0	2^{31}-1	1000	dµm or m°	75
LP48	PositionActionsSelect	Fagor	1290	rw	0	1	0	-----	75
LP49	InbandPosition	Fagor	1290	rw	0	2^{31}-1	5000	dµm or m°	76
LP115	EnableBatteryLowWarning	User	2054	rw	0	1	0	----	77
LP143	ModuloCommandMode	Fagor	787	rw	0	2	2	-----	77
LV13	KernelOperationMode	Fagor	1281	rw	0	1	0	-----	77
LV14	KernelAutoMode	Fagor	1282	rw	0	1	0	-----	77
LV15	KernelStartSignal	Fagor	1282	rw	0	1	0	-----	77
LV16	KernelStopSignal	Fagor	1282	rw	0	1	0	-----	78
LV17	KernelResetSignal	Fagor	1282	rw	0	1	0	-----	78
LV19	KernelManMode	Fagor	1283	rw	0	1	0	-----	78
LV20	JogPositiveSignal	Fagor	1283	rw	0	1	0	-----	78
LV21	JogNegativeSignal	Fagor	1283	rw	0	1	0	-----	78
LV35	BlockTravelDistance	Fagor	1286	ro	-2^{31}	2^{31}-1	0	dµm or m°	78
LV36	BlockCoveredDistance	Fagor	1286	ro	-2^{31}	2^{31}-1	0	dµm or m°	78
LV158	TargetPosition	Fagor	516	ro	-2^{31}	2^{31}-1	0	dµm or m°	79
LV159	PositioningVelocity	Fagor	518	ro	-2^{31}	2^{31}-1	0	mm/min	79
LV160	PositioningAcceleration	Fagor	520	rw	0	2^{31}-1	5000	mm/s^2 or rad/s^2	79
LV161	PositioningAcceleration2	Fagor	522	rw	0	2^{31}-1	5000	mm/s^2 or rad/s^2	79
LV242	TargetPositionAtteined	Fagor	685	ro	0	1	-----	-----	79
MP1	MotorType	Basic	282	rw	----	----	----	-----	80
MP2	MotorTorqueConstant	Fagor	1059	rw	0	100	----	dNm/A	80
MP3	MotorContinuousStallCurrent	Fagor	223	rw	0	5000	----	cA	80
MP4	MotorPeakCurrent	Fagor	219	ro	0	50	----	A	80
NP117	ResolutionOfFeedback2	Fagor	235	rw	0	65535	4096	ppv	80
NP118	ResolutionOfLinearFeedback	Fagor	237	rw	0	65535	200	dµm	81
NP121	InputRevolutions	Fagor	243	rw	1	65535	1	turns	81

Mnem.	Name	Level	IdBus	Acc	Min.	Max.	Def.	Units	Page
NP122	OutputRevolutions	Fagor	245	rw	1	65535	1	turns	81
NP123	FeedConstant	Fagor	246	rw	0	2^{31}-1	5000	dµm or m°	81
NP131	InputRevolutions2	Fagor	8453	rw	1	65535	1	turns	82
NP132	PutputRevolutions2	Fagor	8455	rw	1	65535	1	turns	82
NP133	FeedConstant2	Fagor	8456	rw	0	2^{31}-1	5000	dµm or m°	82
OP1	DA1IDN	User	1099	rw	0	11	4	-----	83
OP2	DA2IDN	User	1099	rw	0	11	7	-----	83
OP3	DA1ValuePer10Volt	User	1099	rw	0	9999	4000	-----	83
OP4	DA2ValuePer10Volt	User	1099	rw	0	9999	3000	-----	83
OP6	DigitalOutputPolarity	User	11025	rw	0	1	0	-----	84
OP14	DigitalOutputFunctionSelector	User	11021	rw	0	7	0	-----	84
OP15	DigitalOutputWarningSelector	User	11023	rw	0	2	0	-----	84
OV10	DigitalOutputs	User	11013	ro	0	1	0	-----	85
OV11	DigitalOutputsCh2	User	11019	rw	0	255	0	-----	85
PC148	DriveControlledHoming	Fagor	297	ro	0	15	0	-----	91
PC150	ChangePosFB12	Basic	1079	rw	0	15	0	-----	91
PP1	HomingVelocitySlow	Fagor	81	rw	0	1200	100	rpm	85
PP41	HomingVelocityFast	Fagor	83	rw	0	6000	200	rpm	85
PP42	HomingAcceleration	Fagor	84	rw	0	2^{31}-1	5000	mm/s^2	85
PP49	PositivePositionLimit	Fagor	98	rw	-2^{31}	2^{31}-1	2^{31}-1	dµm	86
PP50	NegativePositionLimit	Fagor	100	rw	-2^{31}	2^{31}-1	2^{31}-1	dµm	86
PP52	ReferenceDistance1	Fagor	104	rw	-2^{31}	2^{31}-1	0	dµm or m°	86
PP54	ReferenceDistance2	Fagor	108	rw	-2^{31}	2^{31}-1	0	dµm or m°	86
PP55	PositionPolarityParameters	Fagor	111	rw	0	65535	17	-----	86
PP57	PositionWindow	Fagor	114	ro	-2^{31}	2^{31}-1	2000	dµm or m°	87
PP76	PositionDataScalingType	Fagor	153	rw	1	65535	1	-----	87
PP103	Value module	Fagor	206	rw	0	2^{31}-1	360	degrees	87
PP104	PositionKvGain	Fagor	209	rw	0	65535	10	-----	88
PP105	PositionKvGain2	Fagor	211	rw	0	65535	10	-----	88
PP115	PositionFeedback2Type	Fagor	231	rw	0	32	0	-----	88
PP147	HomingParameter	Fagor	295	rw	0	65535	0	-----	89
PP159	MonitoringWindow	Fagor	318	rw	0	2^{31}-1	3000	dµm or m°	89
PP216	VelocityFeedForwardPercentage	Fagor	593	rw	0	120	0	%	90
PP218	VelocityFeedForwardPercentage2	Fagor	1082	rw	0	120	0	%	90
PV47	PositionCommand	Fagor	94	ro	-2^{31}	2^{31}-1	-----	dµm or m°	90
PV51	PositionFeedback1	Fagor	102	ro	-2^{31}	2^{31}-1	-----	dµm or m°	90
PV53	PositionFeedback2	Fagor	106	ro	-2^{31}	2^{31}-1	-----	dµm or m°	90
PV173	MarkerPositionA	User	346	ro	-2^{31}	2^{31}-1	-----	-----	90
PV189	FollowingError	Fagor	378	ro	-2^{31}	2^{31}-1	-----	dµm or m°	90
PV200	HomeSwitch	Fagor	801	ro	0	1	0	-----	91
PV208	ReferenceMarkerPulseRegistered	Fagor	817	ro	0	1	-----	-----	91
QP16	SerialSettings	User	1221	rw	0	65535	1540	-----	91
QV22	IDNListOffInvalidOperationData	Fagor	44	ro	----	----	----	----	92
QV96	SlaveArrangement	User	193	rw	0	127	1	-----	92

Mnem.	Name	Level	IdBus	Acc	Min.	Max.	Def.	Units	Page
SP1	VelocityProportionalGain	Basic	201	rw	0	9999	----	dmArms/rpm	93
SP2	VelocityIntegralTime	Basic	203	rw	0	9999	----	dms	93
SP3	VelocityDerivativeGain	Basic	205	rw	0	9999	0	-----	93
SP10	VelocityLimit	Basic	183	rw	0	9999	1000	rpm	93
SP19	SymmetryCorrection	Basic	11431	rw	-500	500	0	mV	93
SP20	VoltageRpmVolt	Basic	11433	rw	1000	9999	9500	mV	94
SP21	RpmRpmVolt	Basic	11435	rw	10	9999	4000	rpm	94
SP30	VelocityOffset	Basic	11399	rw	-2000	2000	0	crpm	94
SP40	VelocityThresholdNx	User	251	rw	0	9999	1000	rpm	94
SP41	VelocityWindow	User	315	rw	0	9999	20	rpm	94
SP42	StandStillWindow	User	249	rw	0	9999	20	rpm	95
SP43	VelocityPolarityParameters	Basic	87	rw	0	1	0	-----	95
SP45	VelocityCommandSelector	Basic	11427	rw	0	2	0	-----	95
SP60	AccelerationLimit	Basic	277	rw	0	4000	0	drpm/ms	95
SP65	EmergencyAcceleration	Basic	11411	rw	0	4000	0	drpm/ms	96
SP66	VelocityDecelerationTime	Basic	11429	rw	0	4000	0	drpm/ms	96
SV1	VelocityCommand	Basic	72	rw	-6E7	6E7	0	dmrpm	97
SV2	VelocityFeedback	Basic	80	ro	-6E7	6E7	----	dmrpm	97
SV6	VelocityCommandAfterFilters	Basic	11436	ro	-6E7	6E7	----	dmrpm	97
SV7	VelocityCommandFinal	Basic	11416	ro	-6E7	6E7	----	dmrpm	97
SV15	DigitalVelocityCommand	User	11438	rw	-6E7	6E7	0	dmrpm	97
TP1	TorqueThresholdTx	User	253	rw	0	100	5	%	97
TV1	TorqueCommand	User	161	ro	-9999	9999	0	dN·m	98
TV2	TorqueFeedback	User	169	ro	-9999	9999	----	dN·m	98
WV1	GeneratorShape	User	11793	rw	0	2	1	-----	98
WV2	GeneratorPeriod	User	11795	rw	2	9999	200	ms	98
WV3	GeneratorAmplitude	User	11797	rw	0	9999	0	-----	98
WV4	GeneratorType	User	11799	rw	0	2	0	-----	99
WV5	GeneratorOutput	User	11801	ro	-9999	9999	0	-----	99
WV6	GeneratorDutyCycle	User	11803	rw	1	99	50	%	99
WV9	GeneratorOffset	User	11809	rw	-9999	9999	0	-----	99

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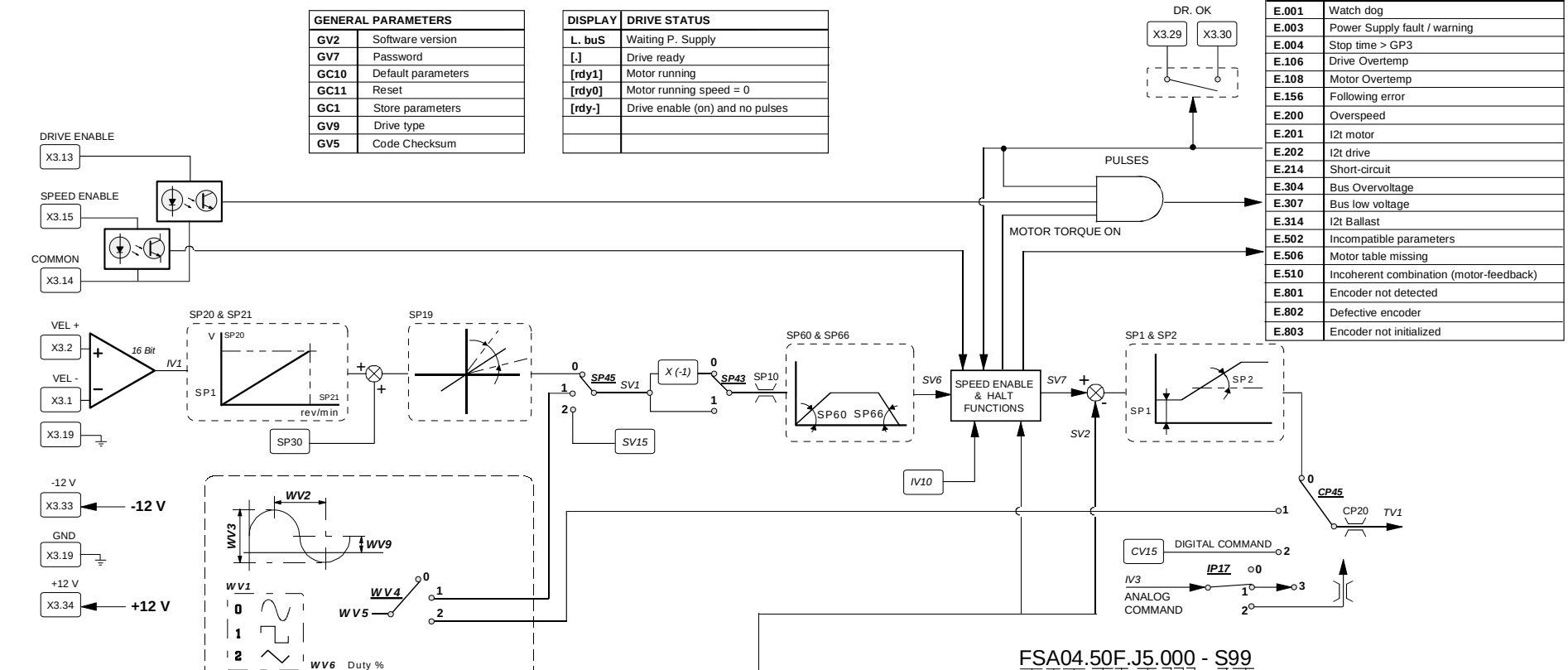
VELOCITY CONTROL BLOCK DIAGRAM

GENERAL PARAMETERS	
GV2	Software version
GV7	Password
GC10	Default parameters
GC11	Reset
GC1	Store parameters
GV9	Drive type
GV5	Code Checksum

DISPLAY	DRIVE STATUS
L. buS	Waiting P. Supply
[.]	Drive ready
[rdy1]	Motor running
[rdy0]	Motor running speed = 0
[rdy-]	Drive enable (on) and no pulses

ERR0R	DESCRIPCIÓN
E.001	Watch dog
E.003	Power Supply fault / warning
E.004	Stop time > GP3
E.106	Drive Overtemp
E.108	Motor Overtemp
E.156	Following error
E.200	Overspeed
E.201	I2t motor
E.202	I2t drive
E.214	Short-circuit
E.304	Bus Overvoltage
E.307	Bus low voltage
E.314	I2t Ballast
E.502	Incompatible parameters
E.506	Motor table missing
E.510	Incoherent combination (motor-feedback)
E.801	Encoder not detected
E.802	Defective encoder
E.803	Encoder not initialized



MOTOR PARAMETERS	
MP1	Motor type
MP2	Torque constant
MP3	Rated current

FSA04.50F.J5.000 - S99

MOTOR SERIES

MOTOR LENGTH
LONG MOTORS A
SHORT MOTORS P

SIZE/POWER

	FSA			FSP		
HEIGTH	200V		kW	200V		kW
40	**01**		0.1			
60				**01**		0.1
	02		0.2			
	04		0.4			
80				**02**		0.2
				04		0.4
	08		0.75			
120				**08**		0.75

MAXIMUM SPEED
50 5.000 rev/min
Note that the rated speed is 3000 rev/min

VOLTAGE
200 V **F**

ESPECIFICATION **01 → ZZ**
only when having the special "S" configuration !

SPECIAL CONFIGURATION **S**

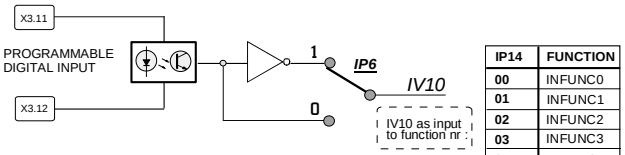
CONNECTION
Interconnectron Connector **0**

BRAKE/SEAL OPTION
Without brake or seal (not considered) **0**
With brake (24 V DC), without seal **1**
With brake (24 V DC), with seal **2**
Without brake, with seal **3**

FLANGE & SHAFT
Eje cilíndrico con chaveta y taladro roscado **0**
Eje cilíndrico liso sin chaveta y taladro roscado **1**

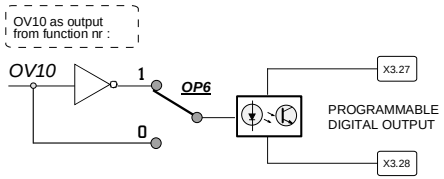
FEEDBACK
13 bit incremental **J5**
16 bit absolute **J7**

I/O FUNCTIONS

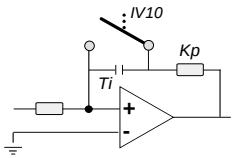


IP14	FUNCTION
00	INFUNC0
01	INFUNC1
02	INFUNC2
03	INFUNC3
04	INFUNC4

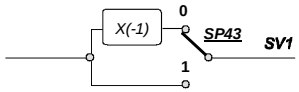
FUNCTION	OP14
OUTFUNC	00
OUTFUNC1	01
OUTFUNC2	02
OUTFUNC3	03
OUTFUNC4	04
OUTFUNC5	05
OUTFUNC6	06
OUTFUNC7	07



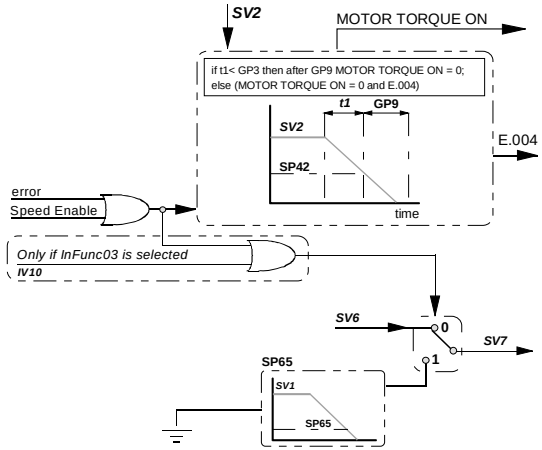
IP14 01 REMOTE P. / P.I. CONTROL



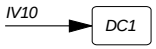
IP14 02 SERVOMOTOR ROTATION DIRECTION



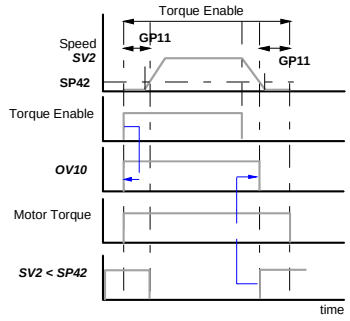
IP14 03 HALT



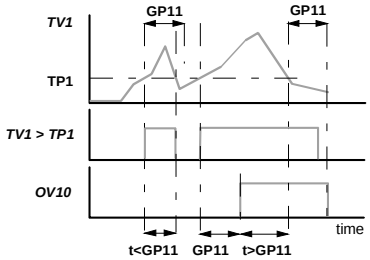
IP14 04 ERROR RESET



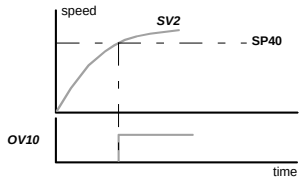
OP14 01 MOTOR BRAKE CONTROL



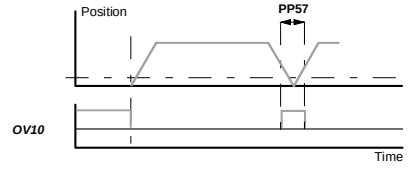
OP14 02 TORQUE LIMIT



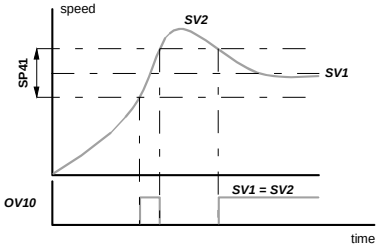
OP14 03 MOTOR SPEED > SP40



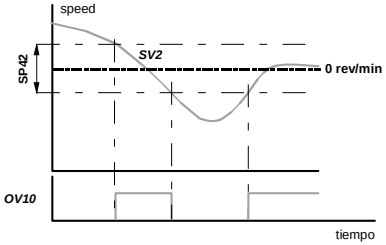
OP14 00 POSITION WINDOW



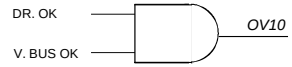
OP14 04 TARGET SPEED



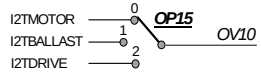
OP14 05 TARGET SPEED < 0 REV/MIN



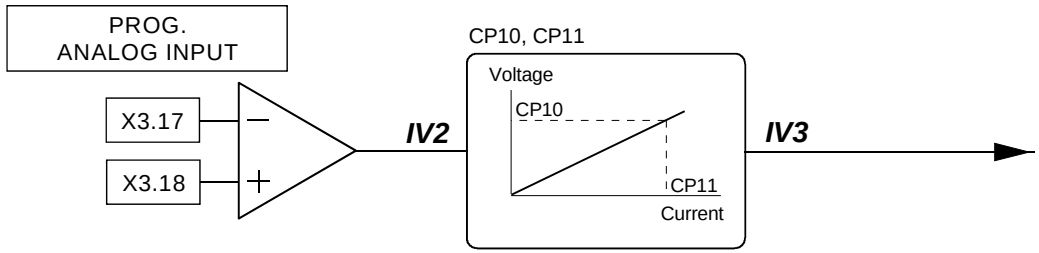
OP14 06 SECOND DRIVE OK



OP14 07 WARNINGS



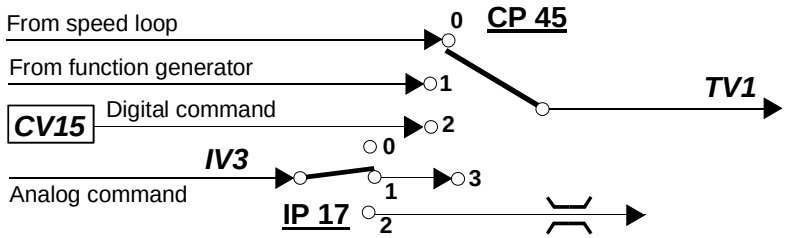
ANALOG FUNCTIONS



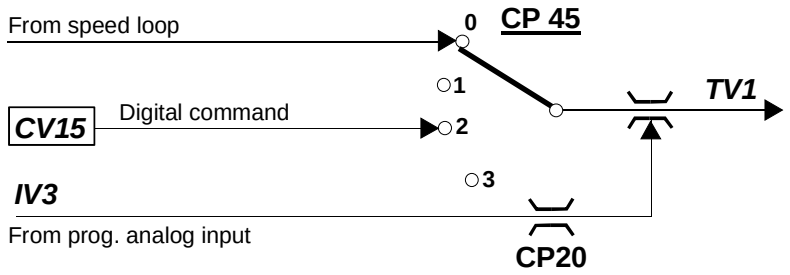
IV3 as input to function nr :

IP17	Function
00	NO FUNCTION
01	FUNCTION 1
02	FUNCTION 2

Function 1 **External current command**



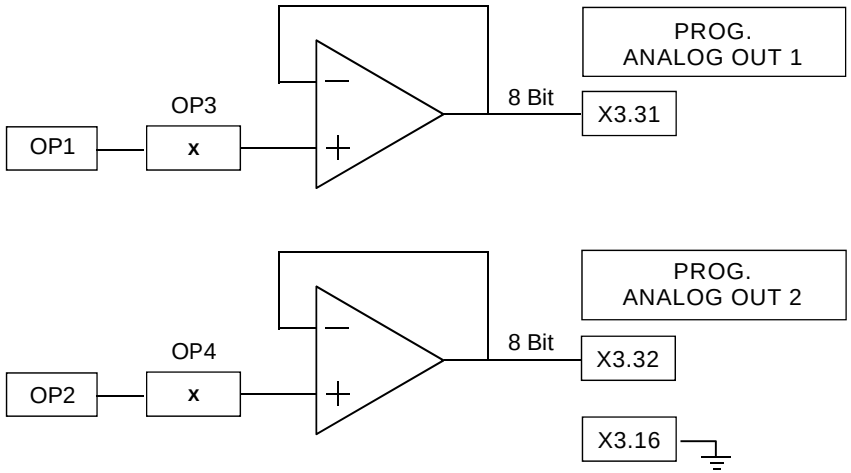
Function 2 **External current limit command**



OP1	VARIABLE
00	SV15
01	SV1
02	SV6
03	SV7
04	SV2
05	TV1
06	TV2
07	CV3
09	IV1
10	IV2
11	RV1
12	RV2
13	PV189

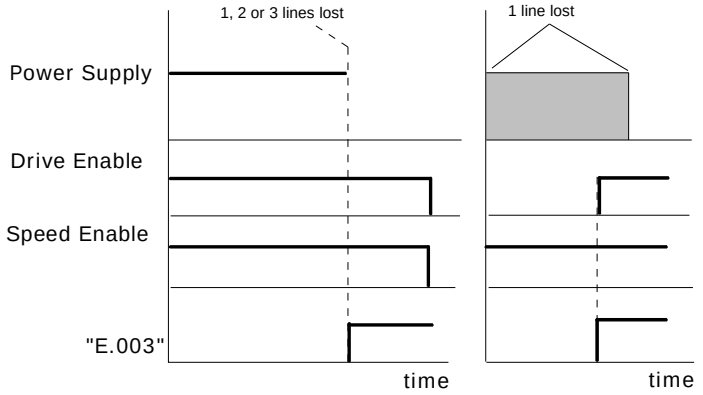
OP2	VARIABLE
00	SV15
01	SV1
02	SV6
03	SV7
04	SV2
05	TV1
06	TV2
07	CV3
09	IV1
10	IV2
11	RV1
12	RV2
13	PV189

UNITS
rev/min
rev/min
rev/min
rev/min
rev/min
dNm
dNm
cA
mV
mV
bits
bits
µm

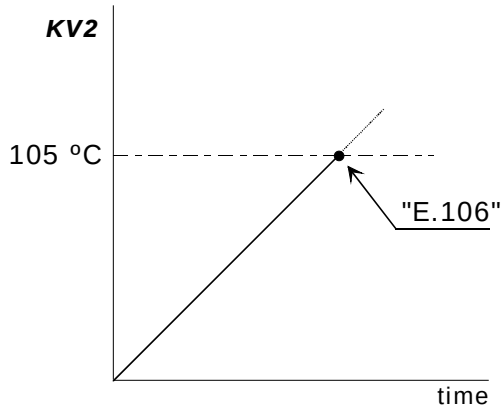


ERROR FUNCTIONS

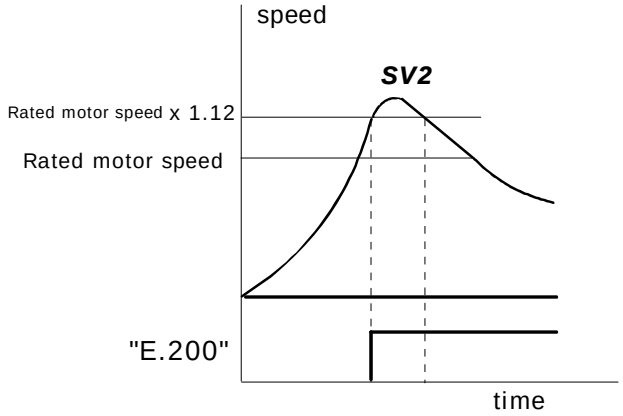
Function "E.003" — **Power Supply fault**



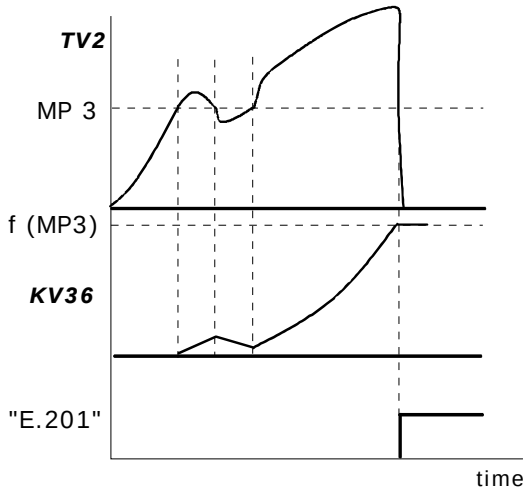
Function "E.106" — **Drive Overtemp**



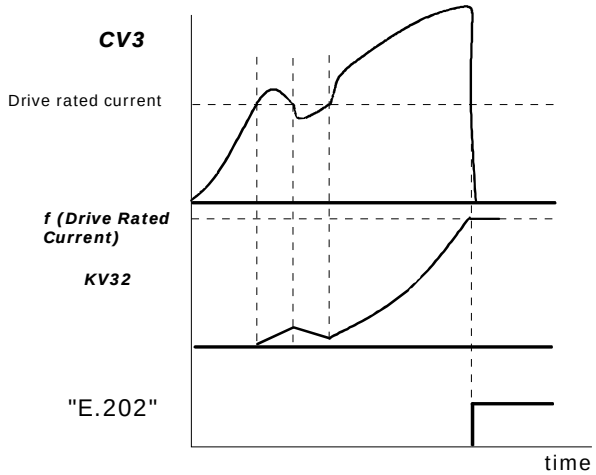
Function "E.200" — **Overspeed**



Function "E.201" — **Motor overload**

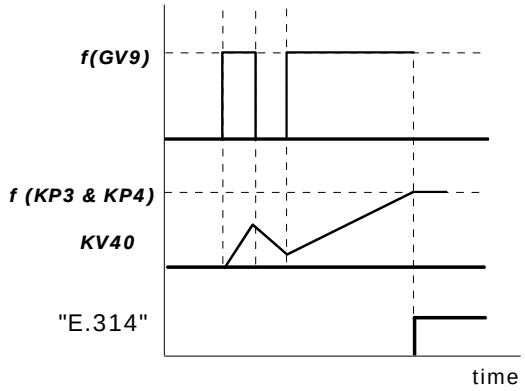


Function " E.202 " — **Drive overload**



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			****	****	****	****
	HWORD	LWORD	HWORD	LWORD	HWORD	LWORD	HWORD			LWORD	HWORD	LWORD	HWORD	LWORD			HWORD	LWORD	HWORD	LWORD
								HBYTE	LBYTE					HBYTE	LBYTE					
ABSOLUTE		0001h					**NONE**		00h						**FFh**	**END**				
INCREMENTAL		0002h					**INRPOS**	**01h** if INIFAST **00h** if not INIFAST	01h					**01h** if INCR-CNT **00h** if not INCR-CNT	Block number from 01h to 80h					
+ INFINITE		0003h	De 00000000h a FFFFFFFFh		De 00000000h a FFFFFFFFh		**INTPOS**		02h	From 0000h to FFFFh	Reserveed	From 0000h to 00FFh	From 0000h to FFFFh				Reserved	Reserved	Reserved	Reserved
- INFINITE	0000h	0004h					**INBAND**		03h											
STOP		0005h					**ACTSPEED**		04h											
							NEXTSPEED		05h											

BLOCK NR	DIRECTION	DWORD1		DWORD2		DWORD3		DWORD4		DWORD5		DWORD6		DWORD7		DWORD8	
		HWORD	LWORD	HWORD	LWORD	HWORD	LWORD	HWORD	LWORD	HWORD	LWORD	HWORD	LWORD	HWORD	LWORD	HWORD	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