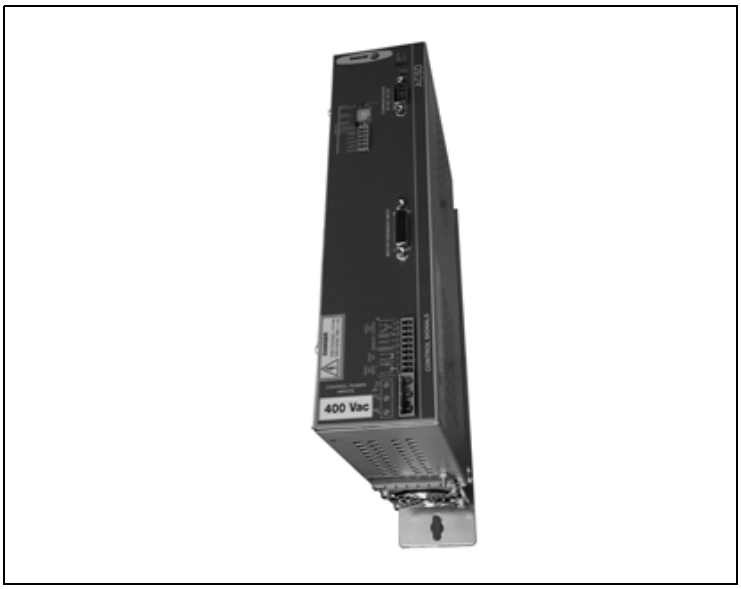
FAGOR AUTOMATION S.COOP.

Brushless **AC**
Servo **D**rives
~ ACSD series ~

Ref.1501



FAGOR

14460063

Original instructions

Title	Brushless AC Servo Drives. ACSD series.
Type of documentation	Description, installation and startup of motors and digital drives.
Name	**MAN REGUL ACSD (IN)**
Reference	Ref.1501
Software	version 02.0x
Electronic document	man_acsd. pdf

Headquarters

FAGOR AUTOMATION S.COOP.
B.º San Andrés 19, Apdo. 144
E- 20500 ARRASATE- MONDRAGÓN
www.fagorautomation.com
info@fagorautomation.es


34-943-719200


34-943-771118 (**T**echnical **S**upport)

DUAL-USE products.
Products manufactured by Fagor Automation S. Coop. included on the list of dual-use products according to regulation (UE) Nr 1382/2014. Their product identification includes the text -MDU and require an export license depending on destination.

WARRANTY

INITIAL WARRANTY

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

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

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

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

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

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

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

EXCLUDING CLAUSES

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

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

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

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

SERVICE CONTRACTS

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

DECLARATION OF CONFORMITY

Manufacturer: Fagor Automation, S. Coop.

B.º San Andrés 19, C.P. 20500, Mondragón - Gipuzkoa - (SPAIN)

We hereby declare, under our responsibility that the product:

Fagor AC Brushless Servo Drive System

Parameter setting for the drive modules.

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

and feed axis servo motors:

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

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

mentioned on this declaration, meet the requirements on:

Safety

EN 60204-1: 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/EC on Electrical Compatibility.

Fagor Automation, S. Coop.

Director Gerente
Pedro Ruiz de Aguirre

In Mondragón July 1st 2009

INTRODUCTION

FAGOR offers you a wide range of servo drive systems (AC Brushless motor and Digital Drive) for applications requiring between 1.2 and 33.6 N·m at speeds between 1200 rpm and 4000 rpm for FXM motors and between 1.7 and 23.5 N·m at speeds between 2000 rpm and 6000 rpm for FKM motors.

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

When installed for the first time, 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, FXM 7

Introduction 7
General characteristics 7
Dimensions 11
Power connectors and encoder output 13
Brake characteristics 15
Sales reference 16

BRUSHLESS AC MOTORS, FKM 17

Introduction 17
General characteristics 17
Dimensions 20
Power connectors and encoder output 21
Brake characteristics 23
Sales reference 24

A.C. SERVODRIVE 25

Introduction 25
General characteristics 25
Dimensions 26
Technical data 26
Connectors 27
Indicators 28
Push-buttons and switches 29
Front panel and pinout of the connectors 30
Characteristics plate 32
Sales reference 32

INSTALLATION 33

General considerations 33
Electrical connections 34
Cables 40
CAN field bus connection 41
Codes of the sales reference of FAGOR cables 42
Connecting a drive to a PC. RS-232 serial line 43
Diagram of the electrical cabinet 43
Initialization and adjustment 45

PARAMETERS, VARIABLES & COMMANDS 49

Notation 49
Groups 51

ERROR CODES 71

PARAMETERS, VARIABLES & COMMANDS. IDs 76

This page intentionally left blank

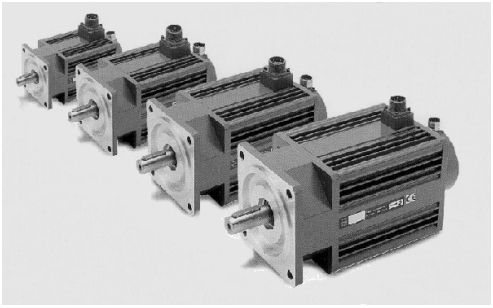
BRUSHLESS AC MOTORS, FXM

Introduction

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

They are ideal for any application requiring great positioning accuracy. They have a uniform output torque, high reliability and low maintenance. They are designed to meet the IP 64 protection standard and, therefore, they are immune to liquid and dirt.

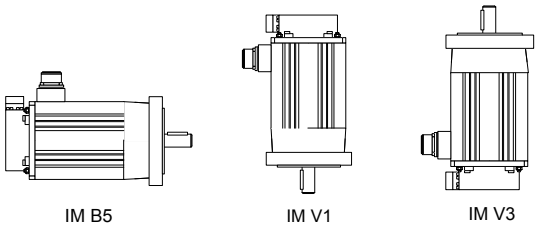
FXM1 FXM3 FXM5 FXM7



IP 64 means that it is protected against dust and against water jets. They incorporate a temperature sensor for monitoring the internal temperature. They also carry an optional electromechanical brake. The F class isolation on the motor maintains the dielectric properties as long as the work temperature stays below 150 °C (302 °F).

General characteristics

T. 1 General characteristics of FXM motors.

Excitation	Permanent rare earth magnets (SmCo)
Temperature sensor	Thermistor
Shaft end	Cylindrical with keyway (optional with no keyway)
Mounting	Face flange
Mounting method	IM B5 - IM V1 - IM V3 (as recommended by IEC-34-3-72)
Mechanical tolerances	Normal class (meets IEC-72/1971)
Balancing	Class N (R optional) (DIN 45665) whole-key balancing
Roller bearings' life	20000 hours
Noise	DIN 45635
Vibration resistance	Withstands 1g, along the shaft and 3g sideways (g=9.81 m/s²)
Electrical insulation	Class F (150 °C - 302 °F)
Insulation resistance	500 V DC, 10 MΩ or greater
Dielectric rigidity	1500 V AC, one minute
Protection degree	General: Standard IP 64. Shaft: Standard IP 64, IP 65 with oil seal
Storage temperature	From - 20 °C to + 80 °C (- 4 °F to + 176 °F)
Ambient temperature	From - 0 °C to + 40 °C (+ 32 °F to + 104 °F)
Working ambient humidity	From 20 % to 80 % (non condensing)
Brake	Optional in all models. See the section "brake characteristics"
Feedback	Incremental I0 TTL encoder SinCos or SinCoder sinusoidal encoder
Meaning of the codes of the mounting method.	

T. 2 Technical data of non-ventilated synchronous FXM motors with “F” winding (220 V AC).

Non-ventilated motors	Stall torque	Stall peak torque	Rated speed	Stall current	Peak current	Calculation power	Torque constant	Acceleration time	Inductance per phase	Resistance per phase	Inertia [1]	Mass [2]	Drive peak torque			
	Mo	Mp	nN	Io	Imax	Pcal	kt	tac	L	R	J	M	ACSD-05L	ACSD-10L	ACSD-20L	ACSD-30L
	Nm	Nm	rpm	Arms	Arms	kW	Nm/Arms	ms	mH	Ω	kg·cm²	kg	Nm	Nm	Nm	Nm
FXM11.40F.□□.□□□	1.2	6	4000	2.0	10.0	0.5	0.6	8.4	12.0	4.60	1.2	3.3	3.0	**6.0**		
FXM12.40F.□□.□□□	2.3	11	4000	3.9	18.7	1.0	0.6	7.2	5.5	1.45	1.9	4.3		6.0	**11.0**	
FXM13.40F.□□.□□□	3.3	16	4000	5.6	27.2	1.4	0.6	6.8	3.5	0.80	2.6	6.4			12.0	**16.0**
FXM14.20F.□□.□□□	4.1	20	2000	3.5	17.1	0.9	1.2	3.5	10.0	2.30	3.3	7.6		12.0	**20.0**	
FXM14.40F.□□.□□□	4.1	20	4000	6.9	33.7	1.7	0.6	6.9	2.6	0.55	3.3	7.6			12.0	18.0
FXM31.20F.□□.□□□	2.6	13	2000	2.2	11.0	0.5	1.2	5.6	24.0	5.05	3.5	5.5	6.0	12.0	**13.0**	
FXM31.40F.□□.□□□	2.6	13	4000	4.4	22.0	1.1	0.6	11.3	6.1	1.25	3.5	5.5		6.0	12.0	**13.0**
FXM32.20F.□□.□□□	5.1	25	2000	4.3	21.1	1.1	1.2	5.0	11.0	1.65	6.0	7.5		12.0	24.0	**25.0**
FXM32.40F.□□.□□□	5.1	25	4000	8.4	41.2	2.1	0.6	10.0	2.9	0.44	6.0	7.5			12.0	18.0
FXM33.20F.□□.□□□	7.3	36	2000	6.3	31.1	1.5	1.2	4.9	6.7	0.90	8.5	9.6			24.0	**36.0**
FXM33.40F.□□.□□□	7.3	36	4000	12.0	59.2	3.1	0.6	9.9	1.8	0.25	8.5	9.6				18.0
FXM34.20F.□□.□□□	9.3	46	2000	7.6	37.6	1.9	1.2	5.0	5.3	0.65	11.0	11.5			24.0	36.0
FXM34.40F.□□.□□□	9.3	46	4000	15.0	74.2	3.9	0.6	10.0	1.3	0.17	11.0	11.5				18.0
FXM53.20F.□□.□□□	11.9	59	2000	9.9	49.1	2.5	1.2	7.8	5.0	0.45	22.0	15.8			24.0	36.0
FXM53.30F.□□.□□□	11.9	59	3000	14.8	73.0	3.7	0.8	11.7	2.2	0.20	22.0	15.8				24.0
FXM54.20F.□□.□□□	14.8	74	2000	12.7	63.5	3.1	1.2	8.2	3.4	0.27	29.0	17.8				36.0
FXM55.12F.□□.□□□	17.3	86	1200	9.1	45.2	2.2	1.9	5.3	7.2	0.55	36.0	20.0			38.0	57.0
FXM55.20F.□□.□□□	17.3	86	2000	15.0	74.6	3.6	1.1	8.8	2.5	0.19	36.0	20.0				33.6
FXM73.12F.□□.□□□	20.8	104	1200	10.7	53.5	2.6	1.9	7.4	9.8	0.60	61.0	29.0				57.0
FXM74.12F.□□.□□□	27.3	135	1200	13.5	66.8	3.4	2.0	7.3	7.8	0.45	79.0	31.6				60.0
FXM75.12F.□□.□□□	29.5	165	1200	15.0	83.9	3.7	2.0	7.4	5.9	0.31	97.0	36.0				60.0

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

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

NOTE. In the combinations shown in bold letters, the drive will limit its peak current automatically so as not to damage the motor.

T. 3 Technical data of non-ventilated synchronous FXM motors with “A” winding (400 V AC).

Non-ventilated motors	Stall torque	Stall peak torque	Rated speed	Stall current	Peak current	Calculation power	Torque constant	Acceleration time	Inductance per phase	Resistance per phase	Inertia [1]	Mass [2]	Drive peak torque		
	Mo	**Mp**	**nN**	**Io**	**Imax**	**Pcal**	**kt**	**tac**	**L**	**R**	**J**	**M**	**ACSD-04H**	**ACSD-08H**	**ACSD-16H**
	Nm	Nm	rpm	Arms	Arms	kW	Nm/Arms	ms	mH	Ω	kg·cm²	kg	Nm	Nm	Nm
FXM11.20A.□□.□□□	1.2	6	2000	0.45	2.2	0.3	2.7	4.2	248	93.5	1.2	3.3	**6.0**		
FXM11.30A.□□.□□□	1.2	6	3000	0.67	3.4	0.4	1.8	6.3	110	43.0	1.2	3.3	**6.0**		
FXM11.40A.□□.□□□	1.2	6	4000	0.90	4.5	0.5	1.3	8.4	62	23.5	1.2	3.3	5.2	**6.0**	
FXM12.20A.□□.□□□	2.3	11	2000	0.86	4.1	0.5	2.7	3.6	111	32.0	1.9	4.3	10.7	**11.0**	
FXM12.30A.□□.□□□	2.3	11	3000	1.29	6.2	0.7	1.8	5.4	49	13.0	1.9	4.3	7.1	**11.0**	
FXM12.40A.□□.□□□	2.3	11	4000	1.72	8.2	1.0	1.3	7.2	28	7.8	1.9	4.3	5.4	10.7	**11.0**
FXM13.20A.□□.□□□	3.3	16	2000	1.23	6.0	0.7	2.7	3.4	71	16.0	2.6	6.4	10.7	**16.0**	
FXM13.30A.□□.□□□	3.3	16	3000	1.85	9.0	1.0	1.8	5.1	32	7.25	2.6	6.4	7.1	14.2	**16.0**
FXM13.40A.□□.□□□	3.3	16	4000	2.50	12.0	1.4	1.3	6.8	18	4.05	2.6	6.4		10.6	**16.0**
FXM14.20A.□□.□□□	4.1	20	2000	1.53	7.5	0.9	2.7	3.5	52	12.0	3.3	7.6	10.7	20.0	
FXM14.30A.□□.□□□	4.1	20	3000	2.30	11.2	1.3	1.8	5.2	23	4.85	3.3	7.6		14.2	**20.0**
FXM14.40A.□□.□□□	4.1	20	4000	3.10	15.0	1.7	1.3	6.9	13	2.95	3.3	7.6		10.6	**20.0**
FXM31.20A.□□.□□□	2.6	13	2000	0.97	4.8	0.5	2.7	5.6	126	29.0	3.5	5.5	10.7	**13.0**	
FXM31.30A.□□.□□□	2.6	13	3000	1.45	7.3	0.8	1.8	8.5	56	12.5	3.5	5.5	7.2	**13.0**	
FXM31.40A.□□.□□□	2.6	13	4000	1.92	9.6	1.1	1.4	11.3	32	7.25	3.5	5.5	5.4	10.8	**13.0**
FXM32.20A.□□.□□□	5.1	25	2000	1.89	9.2	1.1	2.7	5.0	56	9.55	6.0	7.5	10.8	21.6	**25.0**
FXM32.30A.□□.□□□	5.1	25	3000	2.80	14.0	1.6	1.8	7.5	25	4.05	6.0	7.5		14.6	**25.0**
FXM32.40A.□□.□□□	5.1	25	4000	3.80	18.5	2.1	1.4	10.1	14	2.3	6.0	7.5		10.7	21.4

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

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

NOTE. In the combinations shown in bold letters, the drive will limit its peak current automatically so as not to damage the motor.

T. 4 Technical data of non-ventilated synchronous FXM motors with “A” winding (400 V AC).

Non-ventilated motors	Stall torque	Stall peak torque	Rated speed	Stall current	Peak current	Calculation power	Torque constant	Acceleration time	Inductance per phase	Resistance per phase	Inertia [1]	Mass [2]	Drive peak torque		
	Mo	Mp	nN	Io	Imax	Pcal	kt	tac	L	R	J	M	ACSD-04H	ACSD-08H	ACSD-16H
	Nm	Nm	rpm	Arms	Arms	kW	Nm/Arms	ms	mH	Ω	kg·cm²	kg	Nm	Nm	Nm
FXM33.20A.□□.□□□	7.3	36	2000	2.7	13.4	1.5	2.7	4.9	36	5.05	8.5	9.6		21.6	**36.0**
FXM33.30A.□□.□□□	7.3	36	3000	4.1	20.0	2.3	1.8	7.4	16	2.20	8.5	9.6		14.2	28.5
FXM33.40A.□□.□□□	7.3	36	4000	5.5	27.0	3.1	1.3	9.9	8.6	1.15	8.5	9.6			21.3
FXM34.20A.□□.□□□	9.3	46	2000	3.4	17.0	1.9	2.7	5.0	26	3.45	11.0	11.5		21.9	43.8
FXM34.30A.□□.□□□	9.3	46	3000	5.1	25.0	2.9	1.8	7.5	12	1.60	11.0	11.5			29.1
FXM34.40A.□□.□□□	9.3	46	4000	6.9	34.0	3.9	1.4	10.0	6.6	0.85	11.0	11.5			21.6
FXM53.12A.□□.□□□	11.9	59	1200	2.8	14.0	1.5	4.2	4.7	61	5.85	22.0	15.8		34.0	**59.0**
FXM53.20A.□□.□□□	11.9	59	2000	4.7	23.0	2.5	2.5	7.8	22	2.15	22.0	15.8			40.5
FXM53.30A.□□.□□□	11.9	59	3000	7.1	35.0	3.7	1.7	11.7	9.6	0.91	22.0	15.8			26.9
FXM54.12A.□□.□□□	14.8	74	1200	3.5	17.6	1.9	4.2	4.9	44	3.70	29.0	17.8		33.8	67.7
FXM54.20A.□□.□□□	14.8	74	2000	5.9	30.0	3.1	2.5	8.2	16	1.35	29.0	17.8			40.2
FXM54.30A.□□.□□□	14.8	74	3000	8.7	44.0	4.7	1.7	12.3	7.3	0.64	29.0	17.8			27.2
FXM55.12A.□□.□□□	17.3	86	1200	4.1	20.0	2.2	4.2	5.3	36	2.95	36.0	20.0		33.8	67.5
FXM55.20A.□□.□□□	17.3	86	2000	6.7	33.0	3.6	2.6	8.8	13	1.05	36.0	20.0			41.3
FXM73.12A.□□.□□□	20.8	104	1200	4.9	25.0	2.6	4.2	7.4	46	3.05	61.0	29.0			67.8
FXM73.20A.□□.□□□	20.8	104	2000	8.2	41.0	4.4	2.5	12.3	17	1.10	61.0	29.0			40.6
FXM74.12A.□□.□□□	27.3	135	1200	6.6	32.0	3.4	4.2	7.4	33	1.90	79.0	31.6			66.2
FXM75.12A.□□.□□□	33.6	165	1200	8.0	39.0	4.2	4.2	7.4	27	1.45	97.0	36.0			67.2

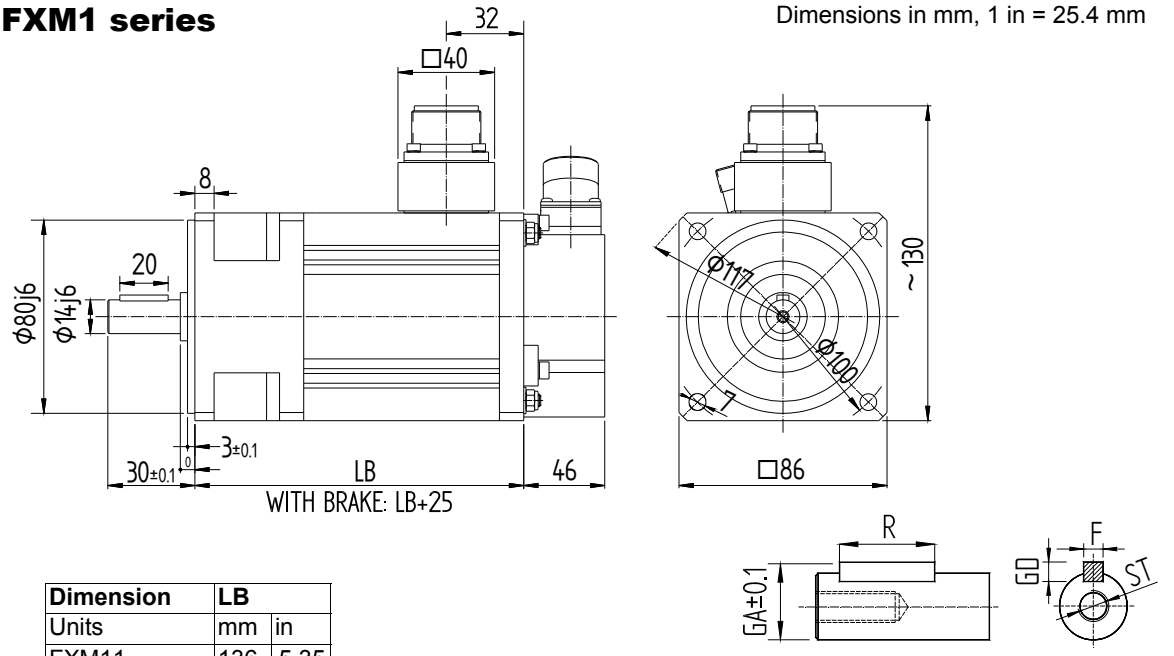
1. When adding the mechanical brake to the motor (optional) also take into account the inertia values given in the table of section “brake characteristics”.
2. When adding the mechanical brake to the motor (optional) also take into account its mass values given in the table of section “brake characteristics”.

NOTE. In the combinations shown in bold letters, the drive will limit its peak current automatically so as not to damage the motor.

Dimensions

FXM1 series

Dimensions in mm, 1 in = 25.4 mm



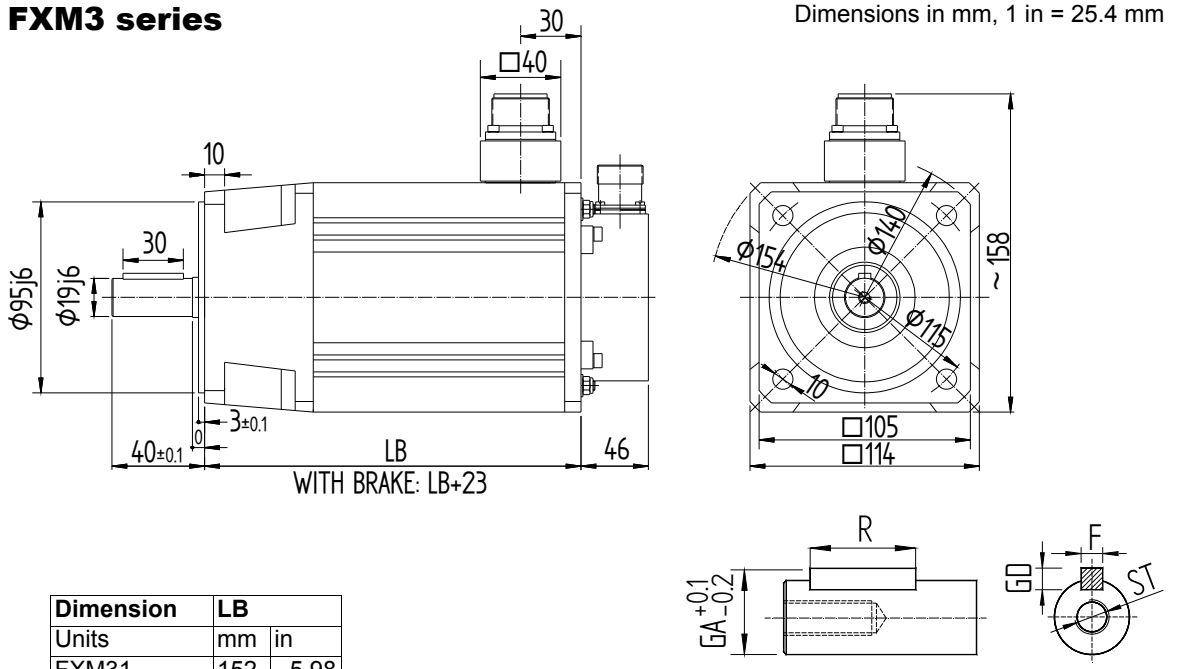
Dimension	LB	
Units	mm	in
FXM11	136	5.35
FXM12	171	6.70
FXM13	206	8.11
FXM14	241	9.48

Dimension	F		GD		R		GA		ST
Units	mm	in	mm	in	mm	in	mm	in	mm
FXM1	5	0.19	5	0.19	20	0.78	16	0.62	M5x12.5

F. 1 Dimensions of FXM1 series motors.

FXM3 series

Dimensions in mm, 1 in = 25.4 mm



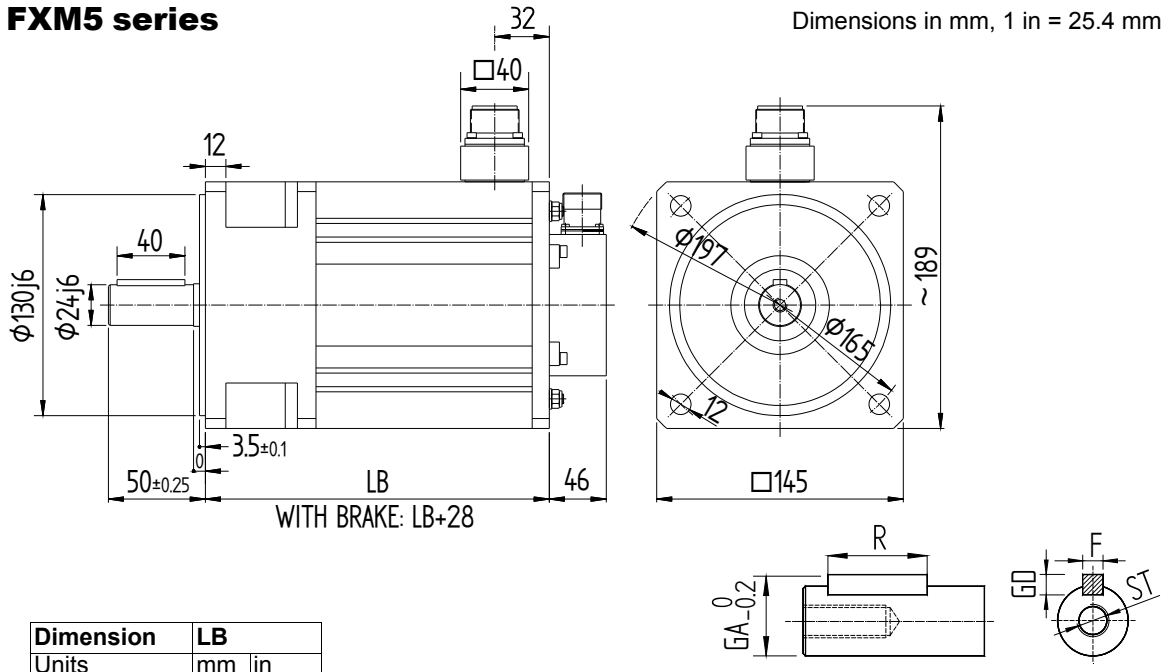
Dimension	LB	
Units	mm	in
FXM31	152	5.98
FXM32	187	7.36
FXM33	222	8.74
FXM34	257	10.12

Dimension	F		GD		R		GA		ST
Units	mm	in	mm	in	mm	in	mm	in	mm
FXM3	6	0.24	6	0.24	30	1.18	21.5	0.85	M6x16

F. 2 Dimensions of FXM3 series motors.

FXM5 series

Dimensions in mm, 1 in = 25.4 mm



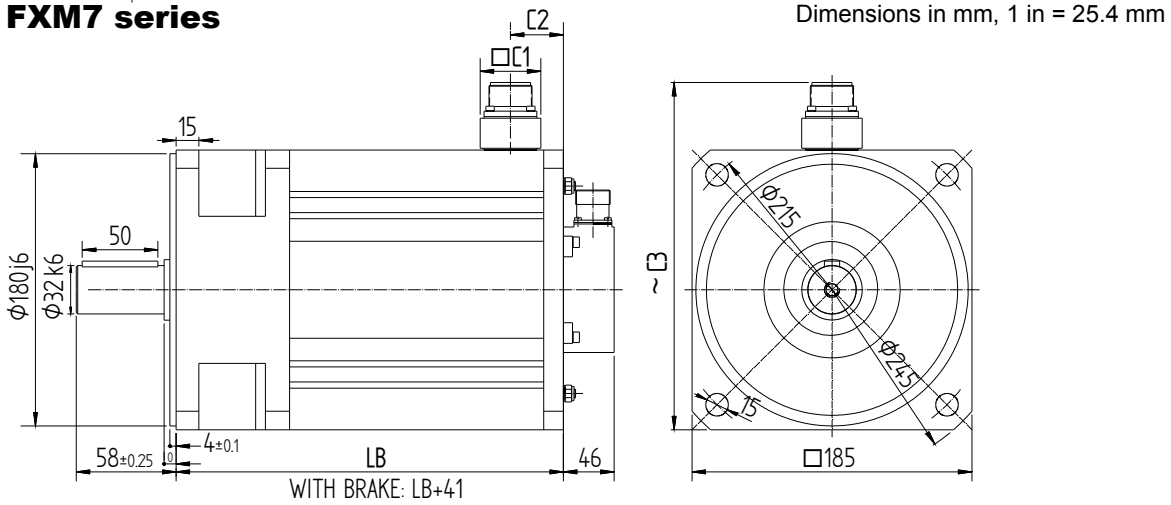
Dimension	LB	
Units	mm	in
FXM53	237	9.33
FXM54	272	10.71
FXM55	307	12.09

Dimension	F		GD		R		GA		ST
Units	mm	in	mm	in	mm	in	mm	in	mm
FXM5	8	0.31	7	0.27	40	1.58	27	1.07	M8x19

F. 3 Dimensions of FXM5 series motors.

FXM7 series

Dimensions in mm, 1 in = 25.4 mm



Dimension	C1		C2		C3	
Units	mm	in	mm	in	mm	in
Io ≤ 23 A (MC 23)	40	1.57	35	1.37	229	9.01
23 A < Io ≤ 46 A (MC 46)	50	1.96	40	1.57	236	9.29

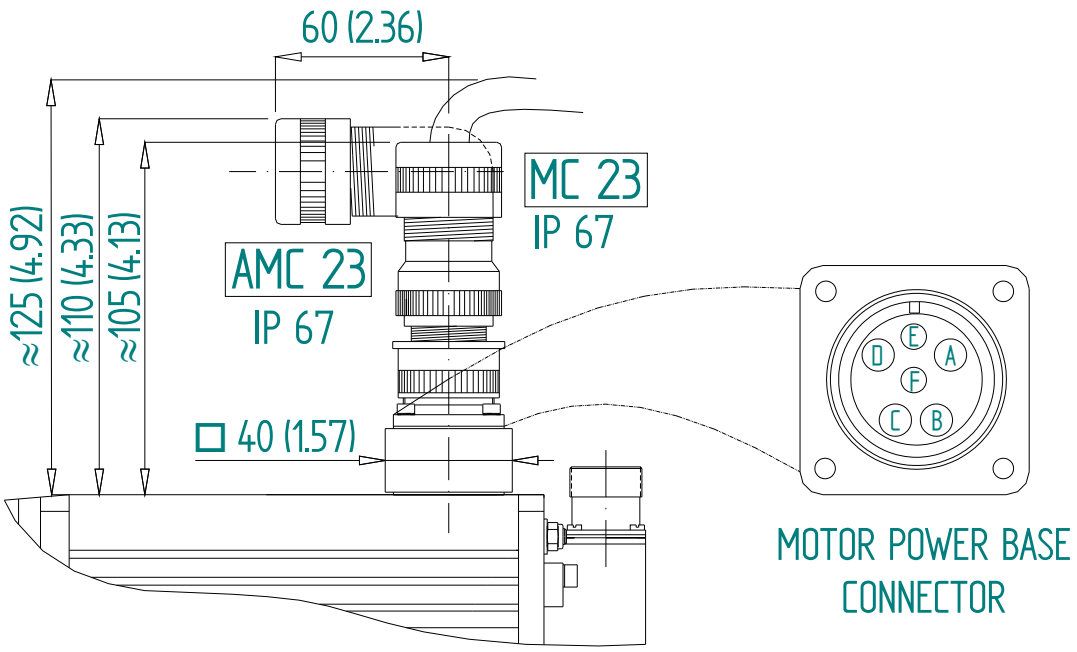
Dimension	LB	
Units	mm	in
FXM73	256	9.33
FXM74	291	10.71
FXM75	326	12.09
FXM76	361	14.21
FXM77	396	15.59
FXM78	431	16.97

Dimension	F		GD		R		GA		ST
Units	mm	in	mm	in	mm	in	mm	in	mm
FXM7	10	0.39	8	0.31	50	1.97	35	1.38	M10x22

F. 4 Dimensions of FXM7 series motors.

Power connectors and encoder output

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



MC 23. POWER AIR CONNECTOR. STRAIGHT
AMC 23. POWER AIR CONNECTOR. ANGLED

PIN	SIGNAL
A	U PHASE
B	V PHASE
C	W PHASE
D	GND
E	BRAKE +
F	BRAKE –

Viewer from outside the motor

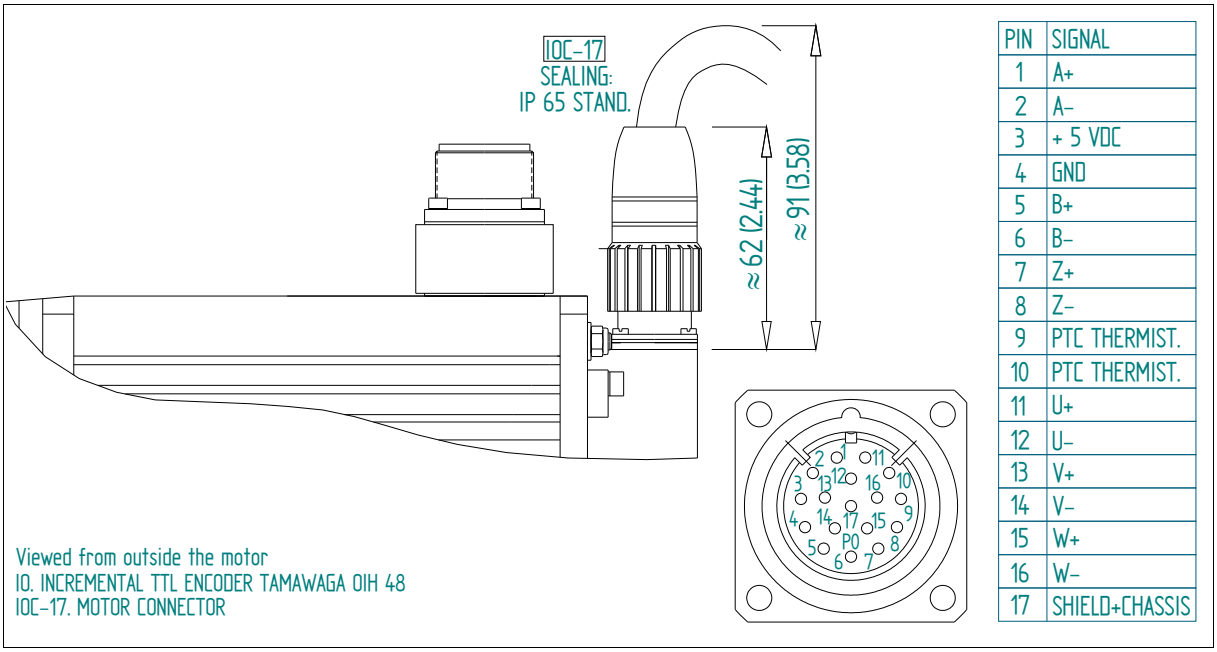
POWER CONNECTORS **EX. MC - 23**

Motor connector — **MC - Straight** / **AMC - Angled**

Current — **23 Amperes**

F. 5 MC-23 or AMC-23 power connector. Sales reference. Pinout and dimensions.

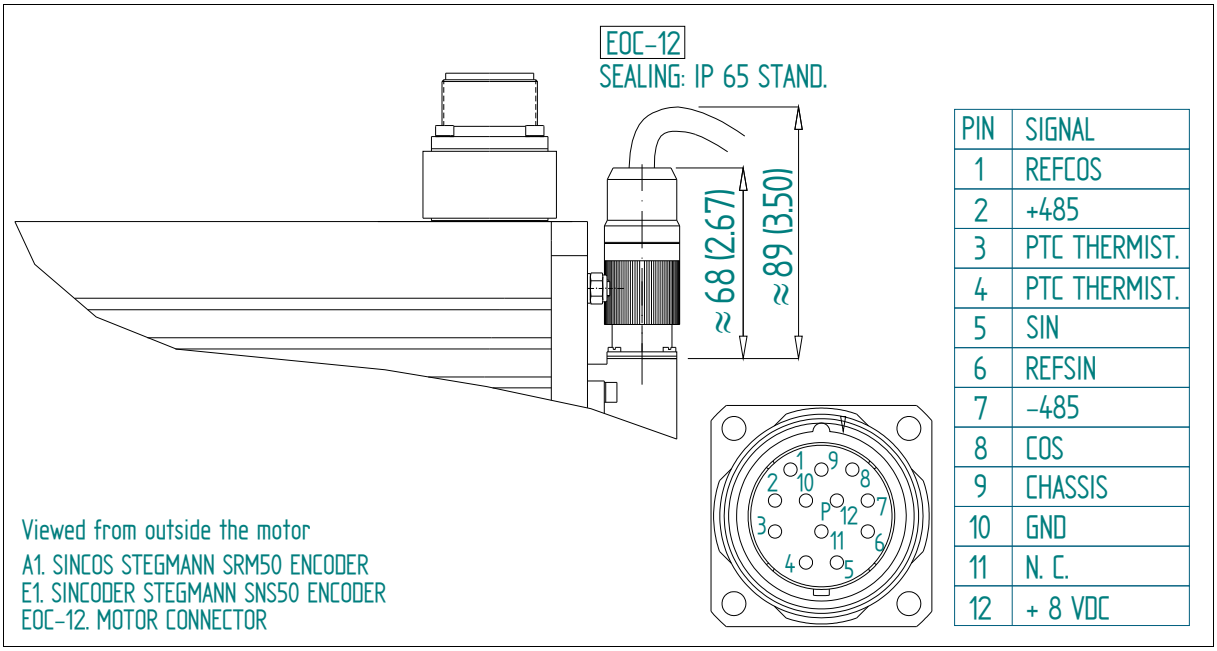
Pins of 9 and 10 of the connector of the incremental TTL encoder correspond to the thermistor used to monitor motor overheating.



PIN	SIGNAL
1	A+
2	A–
3	+ 5 VDC
4	GND
5	B+
6	B–
7	Z+
8	Z–
9	PTC THERMIST.
10	PTC THERMIST.
11	U+
12	U–
13	V+
14	V–
15	W+
16	W–
17	SHIELD+CHASSIS

F. 6 Feedback connector, IOC-17. Incremental TTL encoder (ref. I0). Pinout and dimensions.

Pins of 3 and 4 of the SinCos or SinCoder encoder connector correspond to the thermistor used to monitor motor overheating.



PIN	SIGNAL
1	REFCOS
2	+485
3	PTC THERMIST.
4	PTC THERMIST.
5	SIN
6	REFSIN
7	–485
8	COS
9	CHASSIS
10	GND
11	N. C.
12	+ 8 VDC

F. 7 Feedback connector, EOC-12. SinCos encoder (ref. A1) and SinCoder encoder (ref. E1). Pinout and dimensions.

Brake characteristics

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

T. 5 Technical data of the holding brake

Motor	Holding torque	Power consumption	On/Off time	Releasing voltage margin	Inertia	Mass
Units.	N·m (in·lbf)	W (HP)	ms	V DC	kg·cm²	kg (lbf)
FXM1	Mo motor	12 (0.016)	19/29	22-26	0.38	0.3 (0.66)
FXM3	Mo motor	16 (0.021)	20/29	22-26	1.06	0.6 (1.32)
FXM5	Mo motor	18 (0.024)	25/50	22-26	3.60	1.1 (2.42)
FXM7	Mo motor	35 (0.047)	53/97	22-26	31.80	4.1 (9.03)

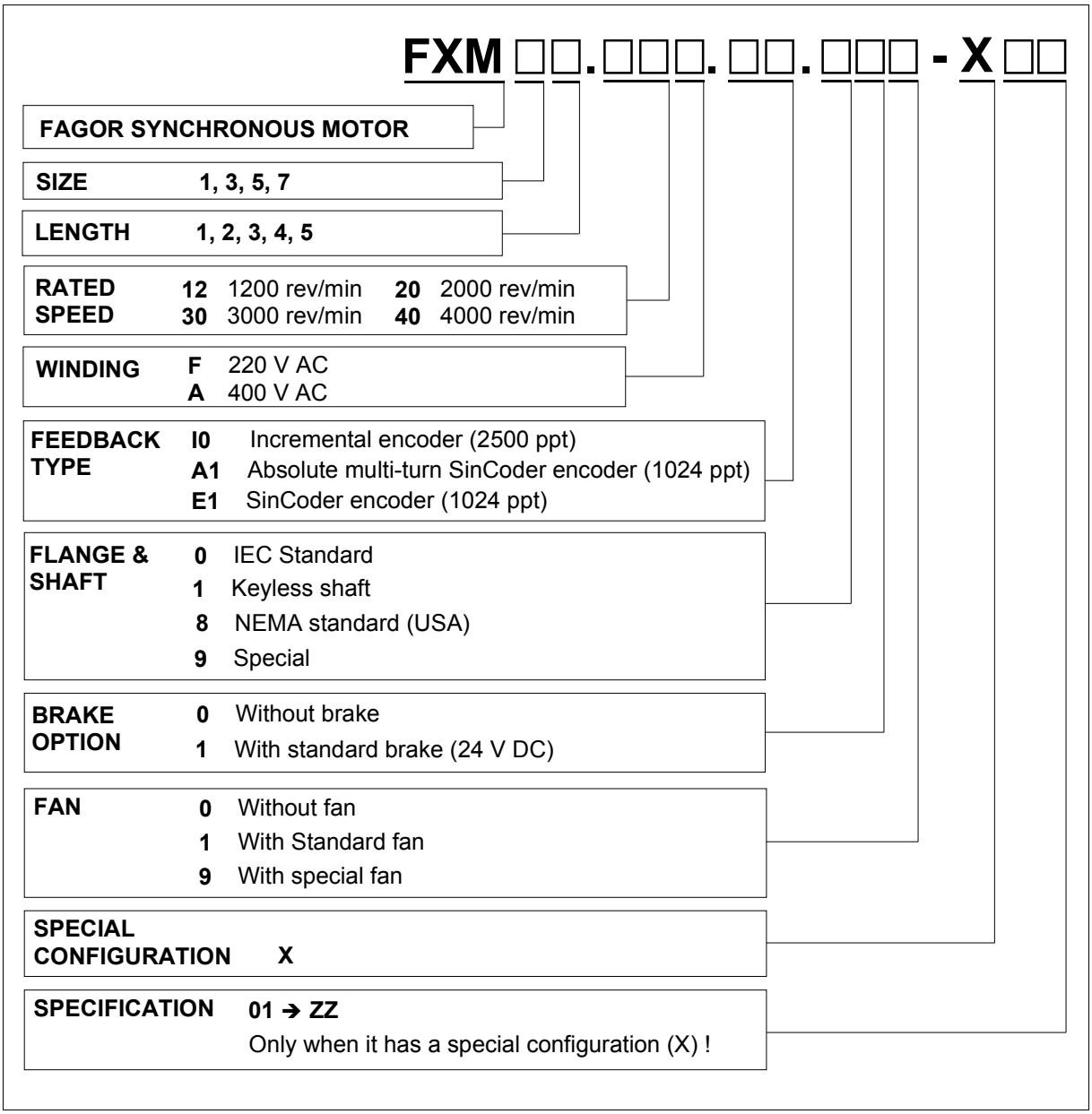
Note. The maximum speed is 10000 rev/min, for all of them except for the brake that may be used on the FXM7 series that is 8000 rev/min.

WARNING. NEVER use this brake to stop a moving axis!

WARNING.

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

Sales reference



NOTE. Motors with “F” winding may have an incremental I0 encoder. The rest of the feedback devices will only be available on motors with “A” winding.

BRUSHLESS AC MOTORS, FKM

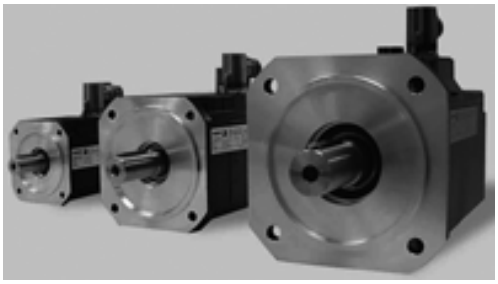
Introduction

FKM synchronous servo motors are AC brushless with permanent magnets.

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

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

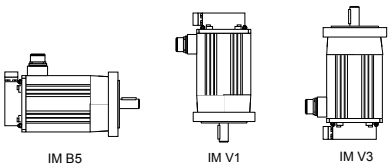
FKM2 **FKM4** **FKM6**



IP 64 means that is protected against dust and against water jets. They have a KTY84-130 sensor to monitor the internal temperature. They also carry an optional electromechanical brake. They have rotating power and feedback connectors. The F class isolation on the motor maintains the dielectric properties as long as the work temperature stays below 150 °C (302 °F).

General characteristics

T. 6 General characteristics of FKM motors.

Excitation	Permanent rare earth magnets (Nd-Fe-B)
Temperature sensor	Thermistor PTC KTY84-130
Shaft end	Cylindrical keyless (optional with keyway)
Mounting	Face flange with through holes
Mounting method	IM B5 - IM V1 - IM V3 (as recommended by IEC-34-3-72)
Mechanical tolerances	Normal class (meets IEC-72/1971)
Balancing	Class N (R optional) (DIN 45665) half-key balancing
Roller bearings' life	20000 hours
Noise	DIN 45635
Vibration resistance	Withstands 1g along the shaft and 3g sideways (g=9.81m/s²)
Electrical insulation	Class F (150 °C - 302 °F)
Insulation resistance	500 V DC, 10 MΩ or greater
Dielectric rigidity	1500 V AC, one minute
Protection degree	General: Standard IP 64. Shaft: Standard IP 64, IP 65 with oil seal
Storage temperature	From - 20 °C to + 80 °C (- 4 °F to + 176 °F)
Ambient temperature	From - 0 °C to + 40 °C (+ 32 °F to + 104 °F)
Working ambient	From 20 % to 80 % (non condensing)
Brake	Optional in all models. See the section "brake characteristics"
Feedback	Incremental I0 TTL encoder SinCos or SinCoder encoder
Meaning of the codes of the mounting method	

T. 7 Technical data of non-ventilated synchronous FKM motors with “A” winding (400 V AC).

Non-ventilated motors	Stall torque	Stall peak torque	Rated speed	Stall current	Peak current	Calculation power	Torque constant	Acceleration time	Inductance per phase	Resistance per phase	Inertia [1]	Mass [2]	Drive peak torque	
	Mo	**Mp**	**nN**	**Io**	**Imax**	**Pcal**	**kt**	**tac**	**L**	**R**	**J**	**M**	**ACSD-08H**	**ACSD-16H**
	Nm	Nm	rpm	Arms	Arms	kW	Nm/Arms	ms	mH	Ω	kg·cm²	kg	Nm	Nm
FKM21.60A.□□.□□□	1.7	7	6000	2.8	11	1.1	0.60	14.4	7.70	2.600	1.6	4.2	4.8	**7.0**
FKM22.30A.□□.□□□	3.2	13	3000	2.4	10	1.0	1.33	7.0	16.00	3.950	2.9	5.3	10.4	**13.0**
FKM22.50A.□□.□□□	3.2	13	5000	4.0	16	1.7	0.80	11.7	5.80	1.400	2.9	5.3	6.4	12.8
FKM22.60A.□□.□□□	3.2	13	6000	4.5	18	2.0	0.71	14.0	4.60	1.100	2.9	5.3		11.3
FKM42.30A.□□.□□□	6.3	25	3000	4.6	19	2.0	1.36	10.7	8.60	1.450	8.5	7.8		21.7
FKM42.45A.□□.□□□	6.3	25	4500	6.9	28	3.0	0.91	16.0	3.90	0.675	8.5	7.8		14.5
FKM42.60A.□□.□□□	6.3	25	6000	8.5	34	3.9	0.74	21.3	2.60	0.450	8.5	7.8		11.8
FKM43.20A.□□.□□□	9.0	36	2000	3.9	15.7	1.88	2.30	9.7	14.5	1.720	16.7	11.7	18.4	**36.0**
FKM43.30A.□□.□□□	9.0	36	3000	6.2	25	2.82	1.45	14.5	6.2	0.755	16.7	11.7		23.2
FKM43.40A.□□.□□□	9.0	36	4000	9.4	38	3.77	0.95	19.4	2.4	0.315	16.7	11.7		15.2
FKM44.20A.□□.□□□	11.6	47	2000	4.6	19	2.4	2.52	7.4	14.51	1.720	16.7	11.7		40.3
FKM44.30A.□□.□□□	11.6	47	3000	8.2	33	3.6	1.41	11.2	4.20	0.540	16.7	11.7		22.5
FKM44.30A.□□.□□□.2	11.6	47	3000	7.0	28	3.6	1.65	11.1	6.16	0.755	16.7	11.7		26.4
FKM62.30A.□□.□□□	8.9	35	3000	7.1	28	2.8	1.25	14.4	7.20	0.770	16.0	11.9		20.0
FKM62.40A.□□.□□□	8.9	35	4000	9.3	37	3.7	0.95	19.1	4.10	0.440	16.0	11.9		15.3
FKM63.20A.□□.□□□	12.5	51	2000	5.3	21.3	2.6	2.35	12.1	13.2	0.935	29.5	17.1		37.6
FKM63.30A.□□.□□□	12.5	51	3000	10.3	40.6	3.9	1.21	18.1	3.8	0.280	29.5	17.1		19.3
FKM64.20A.□□.□□□	16.5	66	2000	6.5	26	3.4	2.53	9.3	13.16	0.935	29.5	17.1		40.6
FKM66.20A.□□.□□□	23.5	94	2000	10.5	42	4.9	2.23	9.5	4.60	0.315	43.0	22.3		35.8
FKM66.20A.□□.□□□.2	23.5	94	2000	9.4	37	4.9	2.50	9.5	8.82	0.410	43.0	22.3		40.0

1. Motor inertia without brake.

2. Motor mass without brake.

NOTE. In the combinations shown in bold letters, the drive will limit its peak current automatically so as not to damage the motor.

T. 8 Technical data of non-ventilated synchronous FKM motors with “F” winding (220 V AC).

Non-ventilated motors	Stall torque	Stall peak torque	Rated speed	Stall current	Peak current	Calculation power	Torque constant	Acceleration time	Inductance per phase	Resistance per phase	Inertia [1]	Mass [2]	Drive peak torque		
	Mo	**Mp**	**nN**	**Io**	**Imax**	**Pcal**	**kt**	**tac**	**L**	**R**	**J**	**M**	**ACSD-10L**	**ACSD-20L**	**ACSD-30L**
	Nm	Nm	rpm	Arms	Arms	kW	Nm/Arms	ms	mH	Ω	kg·cm²	kg	Nm	Nm	Nm
FKM21.60F.□□.□□□	1.7	7	6000	4.7	19	1.1	0.36	14.4	2.6	0.885	1.6	4.2	3.6	**7.0**	-
FKM22.30F.□□.□□□	3.2	13	3000	4.5	18	1.0	0.74	7.0	4.6	1.100	2.9	5.3	7.4	**13.0**	-
FKM22.50F.□□.□□□	3.2	13	5000	7.2	29	1.7	0.45	11.7	1.7	0.425	2.9	5.3	3.6	9.0	**13.0**
FKM42.30F.□□.□□□	6.3	25	3000	8.5	34	2.0	0.74	10.7	2.6	0.450	8.5	7.8	-	14.8	22.2
FKM42.45F.□□.□□□	6.3	25	4500	12.4	50	3.0	0.51	16.0	1.2	0.210	8.5	7.8	-	18.2	**25.0**
FKM43.30F.□□.□□□	9.0	36	3000	13.8	55.4	2.8	0.65	14.5	1.2	0.150	16.7	11.7	-	-	19.5
FKM44.30F.□□.□□□	11.6	47	3000	15.6	62	3.6	0.74	11.2	1.2	0.150	16.7	11.7	-	-	22.2
FKM62.30F.□□.□□□	8.9	35	3000	13.1	52	2.8	0.68	14.4	2.1	0.225	16.0	11.9	-	-	20.4
FKM62.40F.□□.□□□	8.9	35	4000	16.4	66	3.7	0.54	19.1	1.3	0.180	16.0	11.9	-	-	16.2
FKM63.20F.□□.□□□	12.5	51	2000	11.7	46.6	2.6	1.06	12.1	2.7	0.205	29.5	17.1	-	-	31.8
FKM63.30F.□□.□□□	12.5	51	3000	16.6	66.4	3.9	0.75	18.1	1.3	0.100	29.5	17.1	-	-	22.5
FKM64.20F.□□.□□□	16.5	66	2000	14.3	57	3.4	1.15	9.35	2.7	0.205	29.5	17.1	-	-	34.5
FKM64.30F.□□.□□□	16.5	66	3000	20.0	80	5.1	0.82	14.0	1.3	0.145	29.5	17.1	-	-	24.6
FKM66.20F.□□.□□□	23.5	94	2000	19.2	76.8	4.9	1.22	9.57	0.8	0.135	43.0	22.3	-	-	36.6

1. Motor inertia without brake.

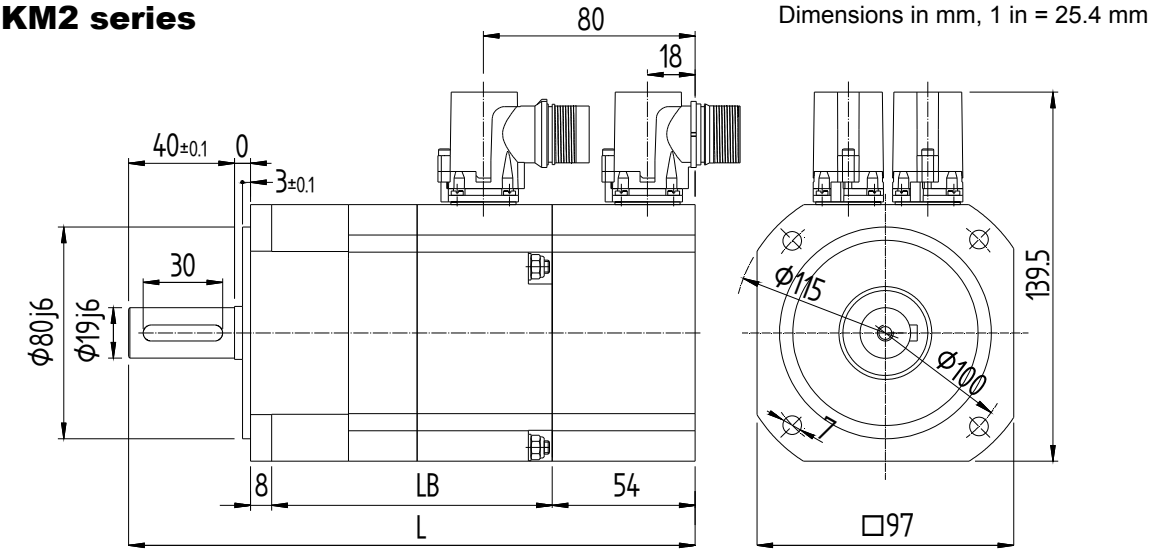
2. Motor mass without brake.

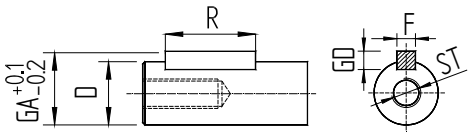
NOTE. In the combinations shown in bold letters, the drive will limit its peak current automatically so as not to damage the motor.

Dimensions

FKM2 series

Dimensions in mm, 1 in = 25.4 mm





Dimension	ØD j6	
Unidades	mm	in
FKM2	19	0.74

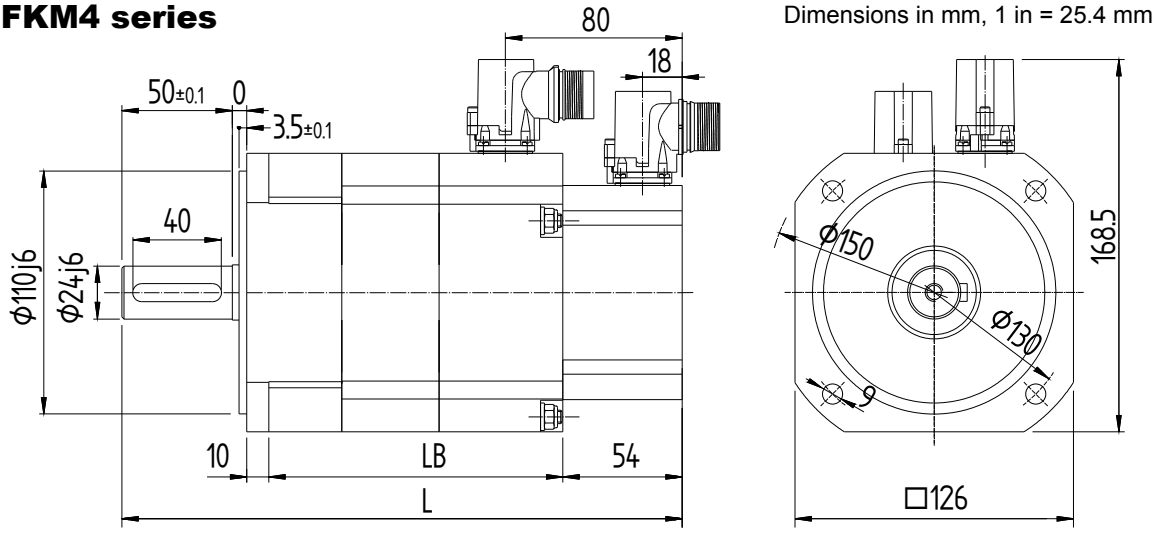
Dimension	LB		L	
Units	mm	in	mm	in
FKM21	106	4.17	208	8.19
FKM22	130	5.11	232	9.13

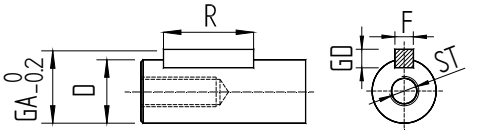
Dimension	F		GD		R		GA		ST
Units	mm	in	mm	in	mm	in	mm	in	mm
FKM2	6	0.23	6	0.23	30	1.18	21.5	0.84	M6x16

F. 8 Dimensions of FKM2 series motors.

FKM4 series

Dimensions in mm, 1 in = 25.4 mm



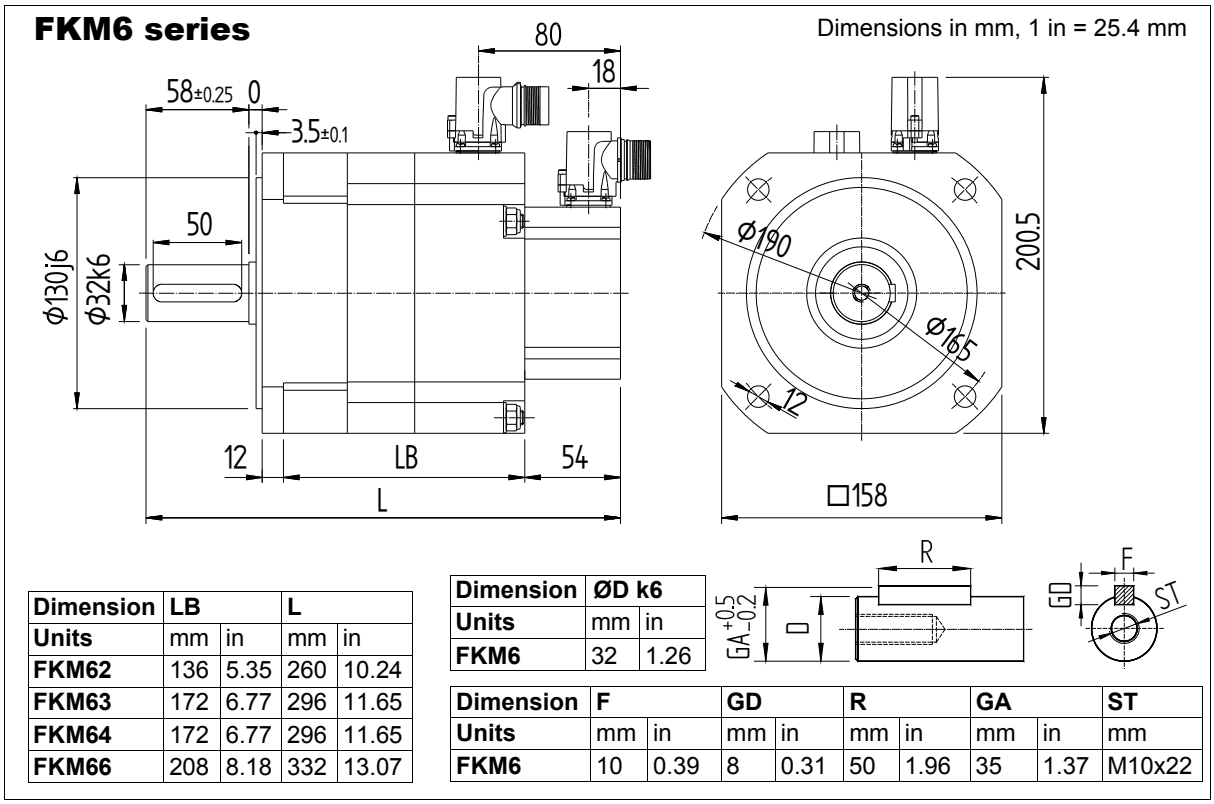


Dimension	ØD j6	
Units	mm	in
FKM4	24	0.94

Dimension	LB		L	
Units	mm	in	mm	in
FKM42	133	5.23	247	9.72
FKM43	175	6.88	289	11.38
FKM44	175	6.88	289	11.38

Dimension	F		GD		R		GA		ST
Units	mm	in	mm	in	mm	in	mm	in	mm
FKM4	8	0.31	7	0.27	40	1.57	27	1.06	M8x19

F. 9 Dimensions of FKM4 series motors.



Dimension	LB		L	
Units	mm	in	mm	in
FKM62	136	5.35	260	10.24
FKM63	172	6.77	296	11.65
FKM64	172	6.77	296	11.65
FKM66	208	8.18	332	13.07

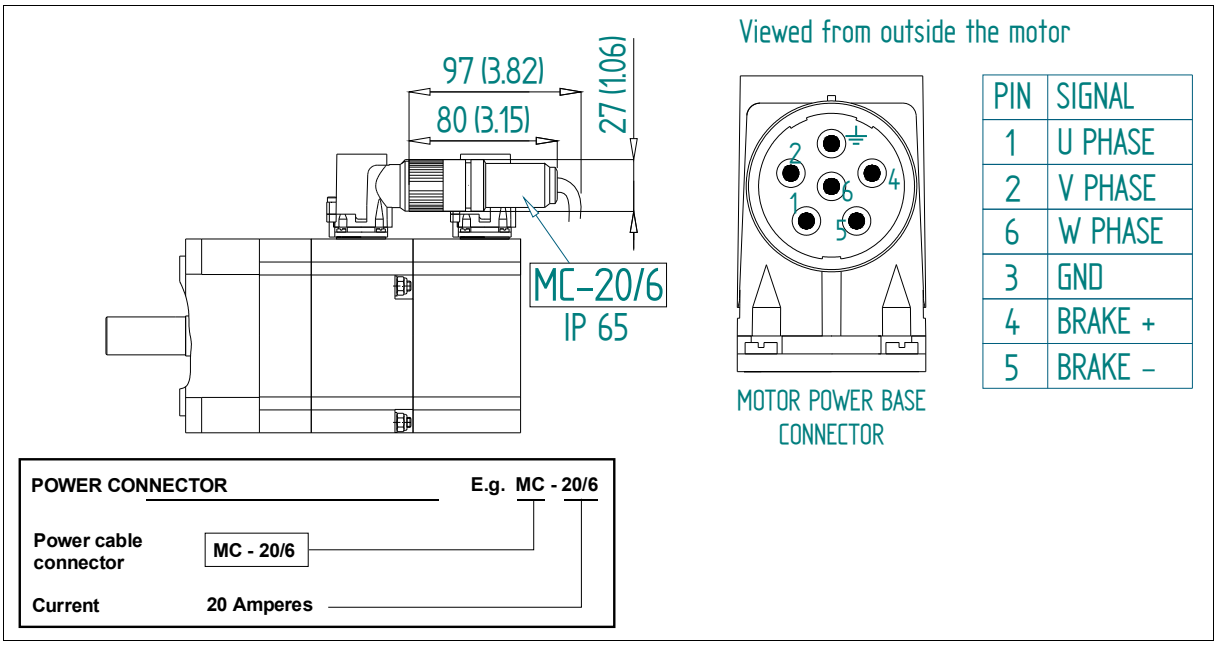
Dimension	ØD k6	
Units	mm	in
FKM6	32	1.26

Dimension	F		GD		R		GA		ST
Units	mm	in	mm	in	mm	in	mm	in	mm
FKM6	10	0.39	8	0.31	50	1.96	35	1.37	M10x22

F. 10 Dimensions of FKM6 series motors.

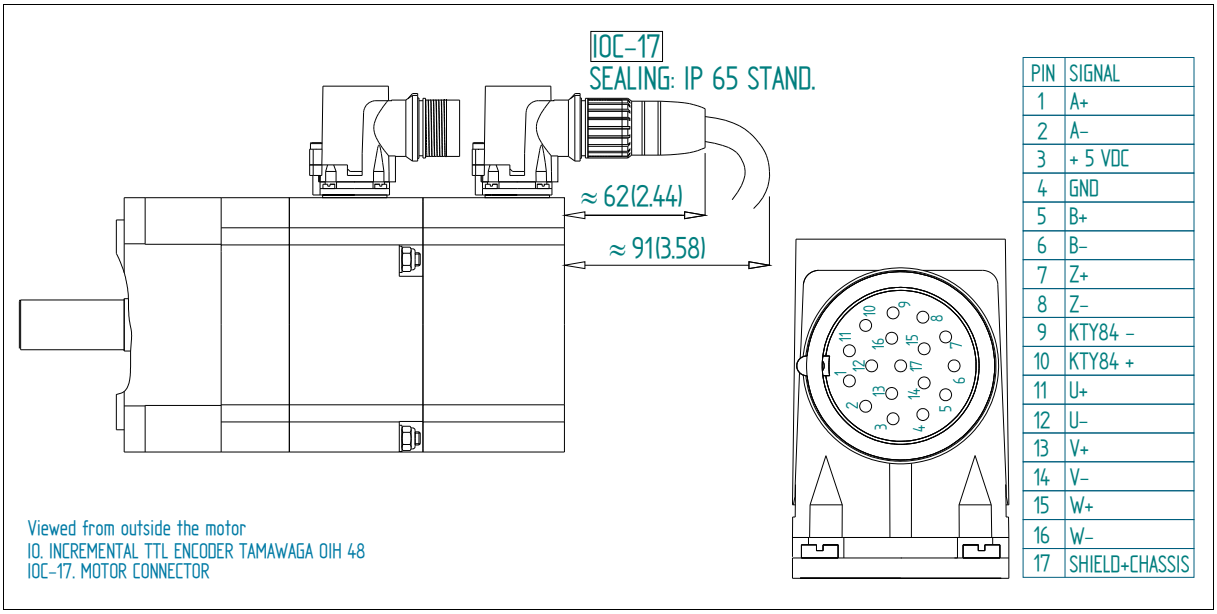
Power connectors and encoder output

It includes the connectors of the brake itself (pins 4 and 5). A voltage between 22 and 26 V DC releases the shaft. When installing the motor, verify that the brake releases the shaft completely before turning it for the first time. Connecting the motor windings in the order indicated on the connector (U, V, W), the shaft will turn clockwise (CWR, **C**lock**W**ise **R**otation).



F. 11 Power connector, MC-20/6. Sales reference, pinout and dimensions.

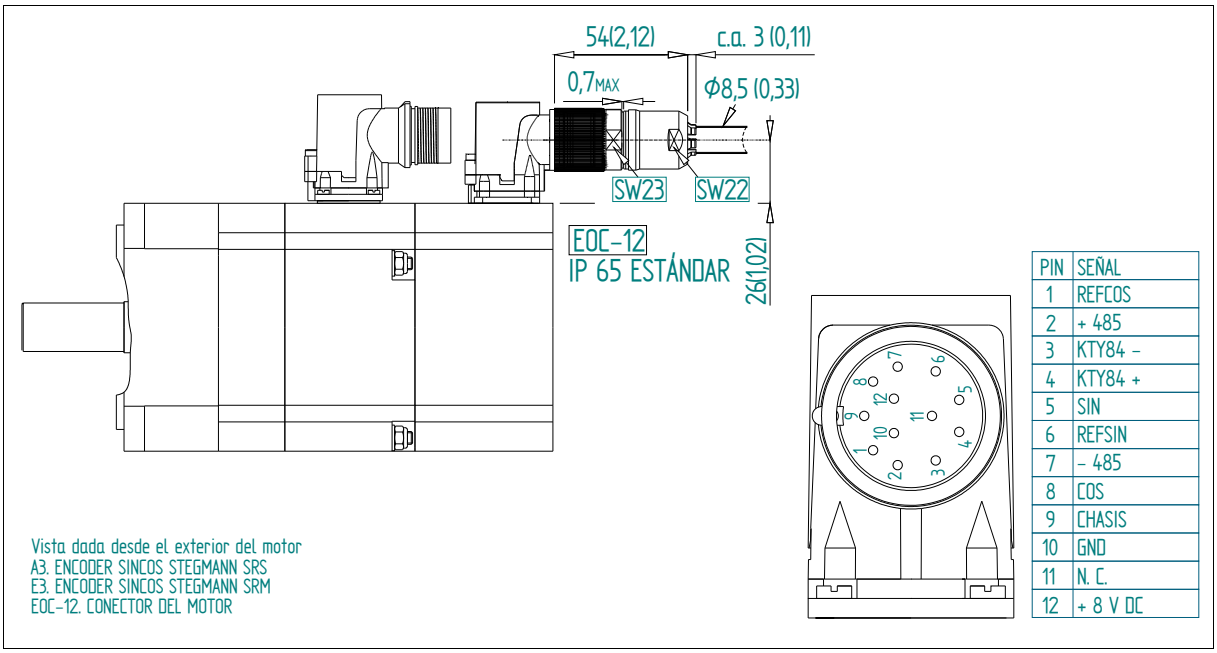
Pins of 9 and 10 of the connector of the incremental TTL encoder correspond to the PTC KTY84-130 thermistor with polarity (-) and (+) respectively used to monitor motor overheating.



PIN	SIGNAL
1	A+
2	A–
3	+ 5 VDC
4	GND
5	B+
6	B–
7	Z+
8	Z–
9	KTY84 –
10	KTY84 +
11	U+
12	U–
13	V+
14	V–
15	W+
16	W–
17	SHIELD+CHASSIS

F. 12 Feedback connector, IOC-17. Incremental TTL encoder (ref. I0). Pinout and dimensions.

Pins of 3 and 4 of the connector of the SinCos encoder correspond to the PTC KTY84-130 thermistor with polarity (-) and (+) respectively used to monitor motor overheating.



PIN	SEÑAL
1	REFCOS
2	+ 485
3	KTY84 –
4	KTY84 +
5	SIN
6	REFSIN
7	– 485
8	COS
9	CHASIS
10	GND
11	N. C.
12	+ 8 V DC

F. 13 Feedback connector, EOC-12. SinCos encoder (ref. A3 & E3). Pinout and dimensions.

Brake characteristics

FKM motors have an optional brake that applies friction to the shaft. Its purpose is to immobilize or lock vertical axes, not to brake a moving axis.

Its main characteristics depending on the type of brake are:

T. 9 Technical data of the brake

Motor	Holding torque	Power consumption	On/Off time	Range of releasing voltage	Inertia	Mass
Units.	N·m (lbf·ft)	W (hp)	ms	V DC	kg·cm²	kg (lbf)
FKM2	4.5 (3.32)	12 (0.016)	7/35	22-26	0.18	0.30 (0.66)
FKM4	9.0 (6.64)	18 (0.024)	7/40	22-26	0,54	0.48 (1.06)
FKM6	18.0 (13.28)	24 (0.032)	10/50	22-26	1.66	0.87 (1.92)

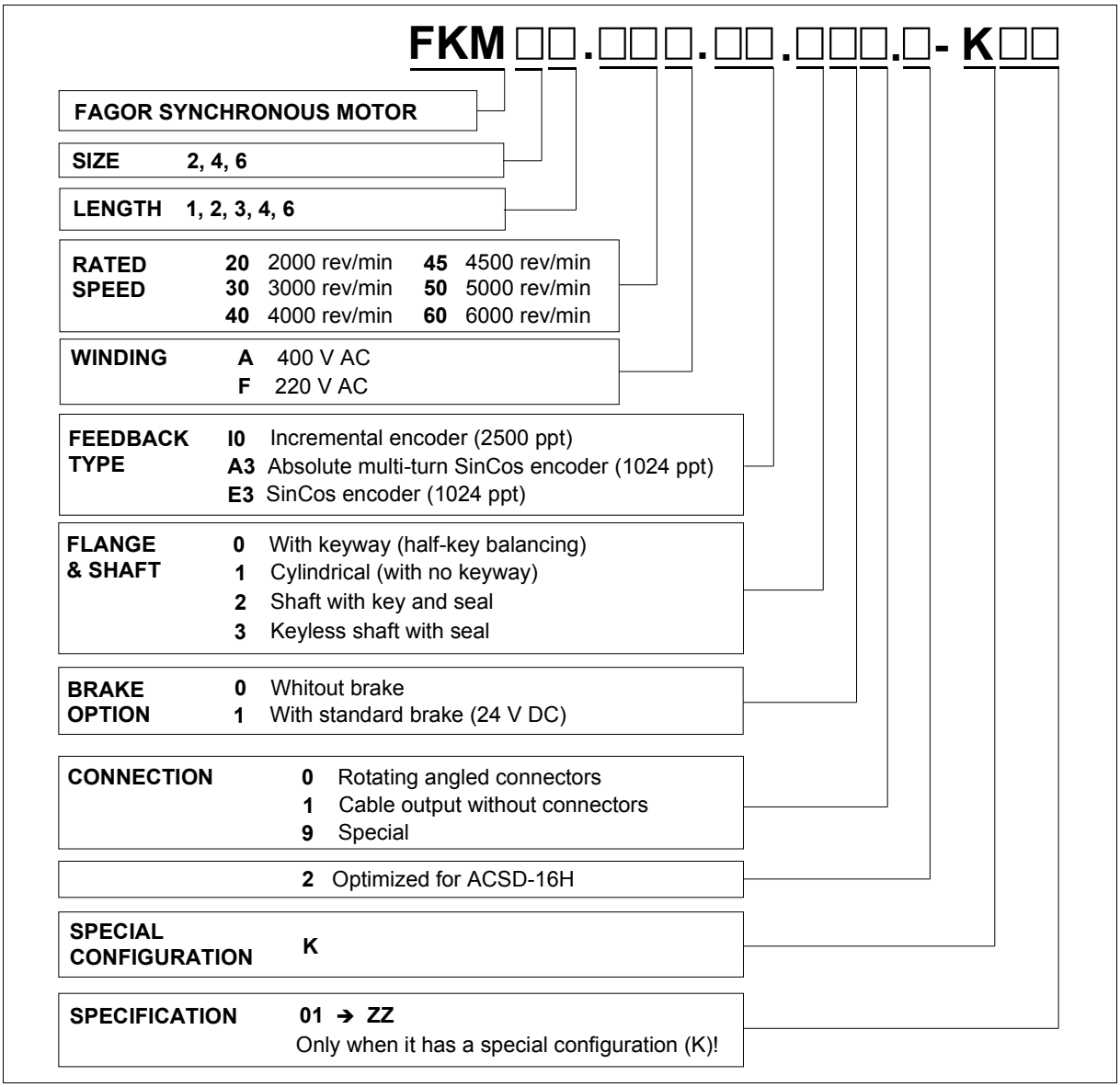
Note. Maximum speed for all of them is 10000 rev/min.

WARNING.
NEVER use this brake to stop a moving axis!

WARNING.

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

Sales reference



NOTE. Motors with “F” winding may have an incremental I0 encoder. The rest of the feedback devices will only be available on motors with “A” winding.

A.C. SERVODRIVE

Introduction

The ACSD family is a compact speed servo drive family for controlling Synchronous AC brushless motors.

It has two series depending on the supply voltage they can be connected to: Hence, we will refer to:

ACSD (H series) if the power supply voltage is 400 V AC
ACSD (L series) if the power supply voltage is 220 V AC

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

- For the “ACSD-xxH” series:

ACSD-04H	**ACSD-08H**	**ACSD-16H**	

  with peak currents of 4, 8 and 16 Arms.

- For the “ACSD-xxL” series:

ACSD-05L	**ACSD-10L**	**ACSD-20L**	**ACSD-30L**

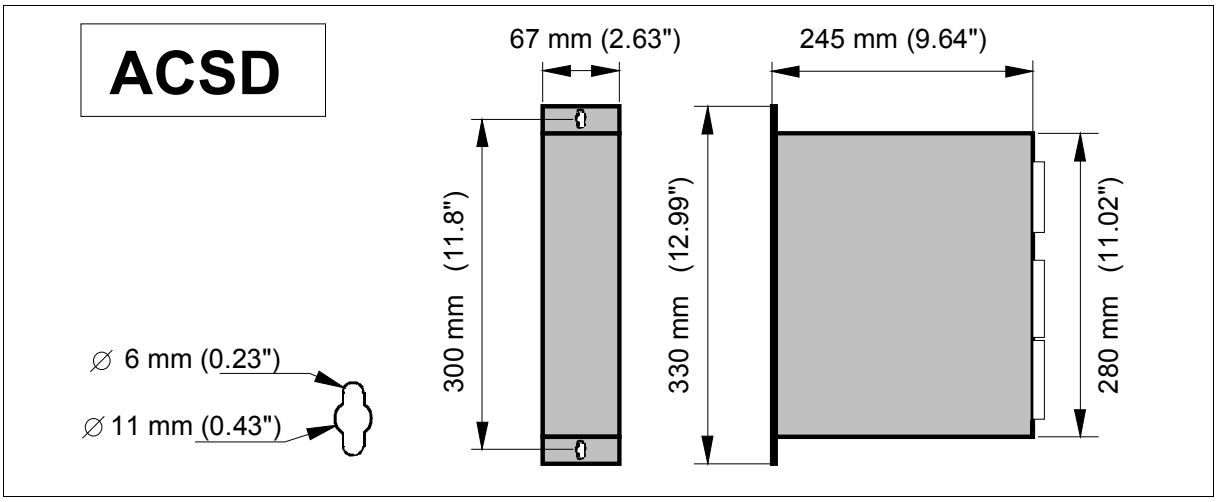
  with peak currents of 5, 10, 20 and 30 Arms.

General characteristics

Their main characteristics are:

- Three phase power supply.
- Dynamic braking in case of mains failure.
- PWM IGBTs.
- 2500-line incremental TTL encoder feedback or 1Vpp sinusoidal encoder.
- CAN field bus communication interface.
- Two logic inputs to control the motor (Speed Enable and Drive Enable).
- One programmable logic input.
- One programmable logic output.
- “On-line” parameter editing.
- Typical protections in velocity drives.
- RS-232 communication (only for uploading software).
- CANopen communication protocol.

Dimensions



F. 14 Dimensions of the ACSD drives.

Technical data

	220 V - L series -				400 V - H series -		
	05	10	20	30	04	08	16
Rated output I (Arms)	2.5	5	10	15	2	4	8
Peak current (0.5 s) (Arms)	5	10	20	30	4	8	16
Power supply	3 AC 220/240 V ± 10 % 50/60 Hz ± 10 %				3 AC 400/460 V ± 10 % 50/60 Hz ± 10 %		
Consumption (Arms)	5.6	11.1	22.2	33.3	4.4	8.9	16.7
[1] On single-phase models	(9.5)[1]	(18.5)[1]					
Over-voltage protection	430 V DC				803 V DC		
Frequency	Lower than 600 Hz						
Internal Ballast (Ω)	112	56	28	18	132	132	66
Power of the internal Ballast	150 W						
Ballast trigger	416 V DC				780 V DC		
Thermal protection of the heatsink	90°C (194°F)						
Operating temperature	5°C / 45°C (41°F / 113°F)						
Storage temperature	- 20°C / 60°C (- 4°F / 140°F)						
Protection degree	IP 20						
Dimensions	67 x 280 x 245 mm (2.48 x 11.8 x 9.05 inches)						
Mass	3.85 kg (8.5 lb)						

IP 20 means that it is protected against objects of a diameter larger than 12.5 mm, but not against water splashes. Put the unit inside an electrical cabinet.

INFORMATION. [1] Modules ACSD-05L and ACSD-10L (220 V AC) may be supplied with a single-phase power voltage. See GP16.

Connectors

Power terminals

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

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

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

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

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

Control signals

20 mA OUT

Voltage ± 12 V, (pins 1, 2, 3 of X1). Output of an internal power supply so the user can easily generate a device enabling signal.

PROG. DIGIT. OUTPUT

Programmable digital output (pins 1 and 2 of X2). Opto-coupled open collector output. Max. current (100 mA), max. voltage (50 V).

ENABLES

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

Drive Enable, (pin 4 of X2). No current can flow through the motor winding at 0 V DC, i.e. without torque.

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

NOTE. These control signals are activated with + 24 V DC.

DRIVE OK.

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

PROG. DIGIT. INPUT

Programmable digital input, (pins 8 and 9 of X2). Programmable digital input.

MOTOR FEEDBACK INPUT

Input connector of the encoder signals installed on the motor for “position + velocity” feedback and of the temperature sensor of the motor.

NOTE. The maximum cable section at these terminals is 0.5 mm². See chapter **INSTALLATION**.

RS232 COMMUNICATIONS

Connector for downloading the software version from a PC to the drive through the RS-232 serial line.

CAN BUS

CANopen bus card
(meets DS-301 standard regarding communications).

GNDa	pin 1 (X4)	Not connected
CANL	pin 2 (X4)	L input
SHIELD	pin 3 (X4)	Cable shield
CANH	pin 4 (X4)	H input
SHIELD	pin 5 (X4)	Not connected

Indicators

BUS ACTIVITY. Indicator light on top of the CAN bus connector (X4). It has several lighting sequences that indicate the status of both the CAN and of the drive. For further detail, see section **Initialization and adjustment** of this manual.

+ 5 V. Indicator light located to the right of the BUS ACTIVITY indicator. When lit, it indicates that the internal + 5 V are being applied.

CROWBAR (ON). Indicator light on top of the **RESET** button. When lit, it indicates that the voltage of the internal bus has exceeded the preset voltage values and the ballast resistor has been activated.

VBUS OK. Indicator light on top of the **RESET** button. When lit, it indicates that there is power voltage.

Push-buttons and switches

RESET. Push-button for resetting the system.

NODE SELECT. Rotary switch that sets the node number assigned to the drive on the CAN bus. For further detail, see section **Initialization and adjustment** of this manual.

SPEED SELECT. Switch that allows selecting the communication speed of the CAN bus. For further detail, see section **Initialization and adjustment** of this manual.

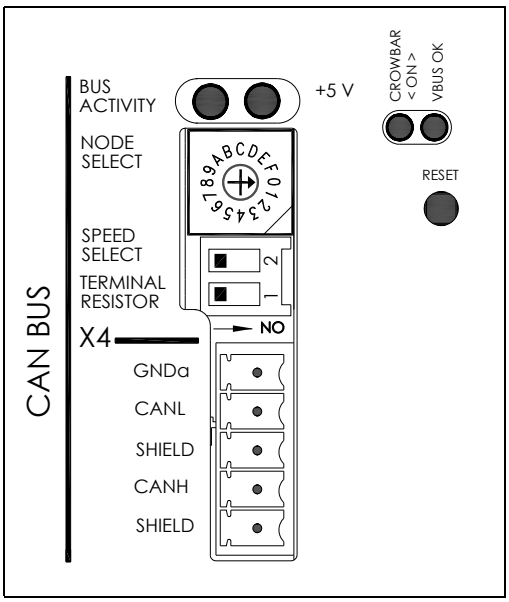
TERMINAL RESISTOR

Selector that, when in the “ON” position, connects the line terminating resistor between CANL and CANH of the bus.

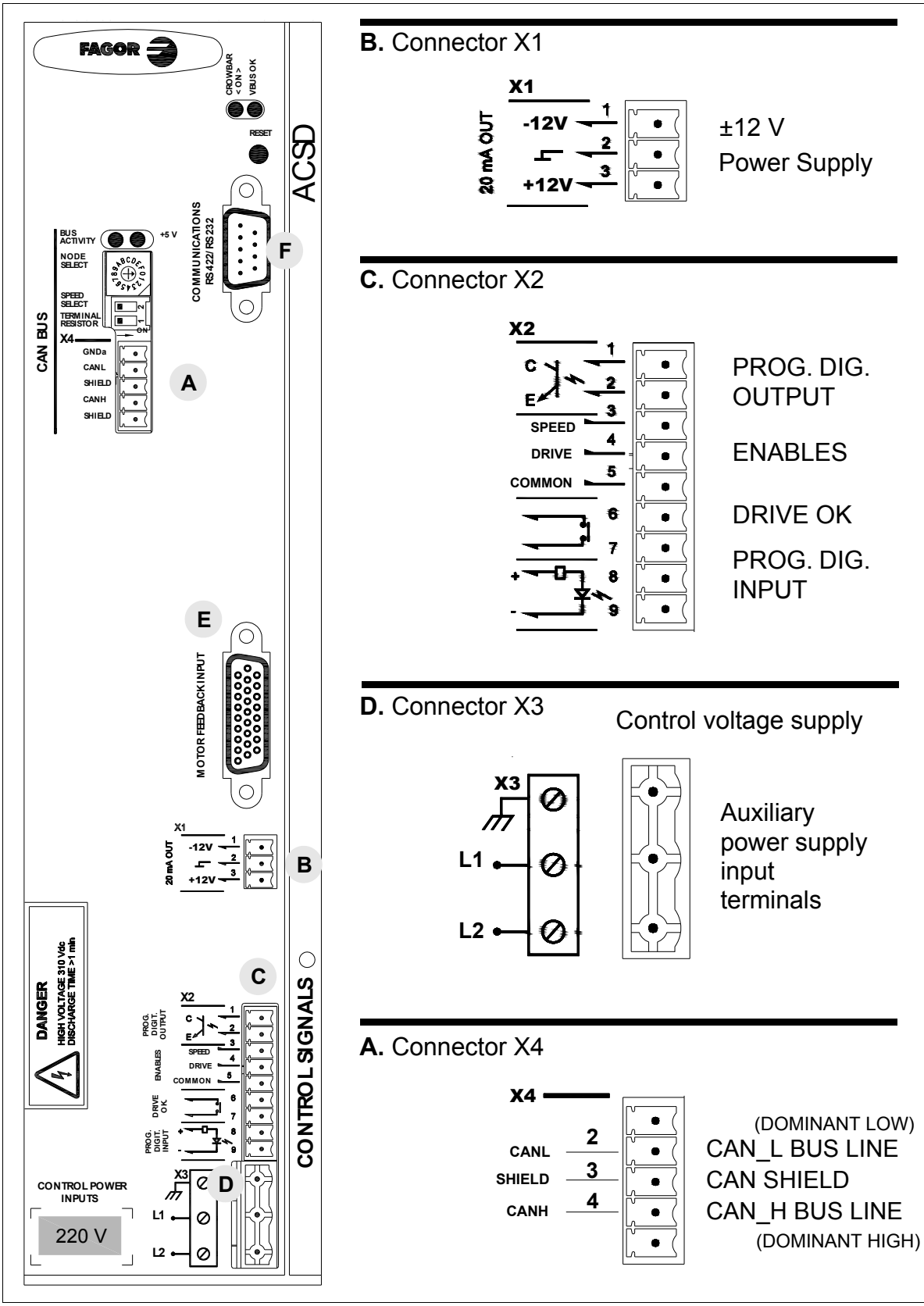
Always activate **ON** at the drive connected at the farthest end of the bus cable.

At the rest of the drives that make up the system, **ON** must always be deactivated.

See attached figure.



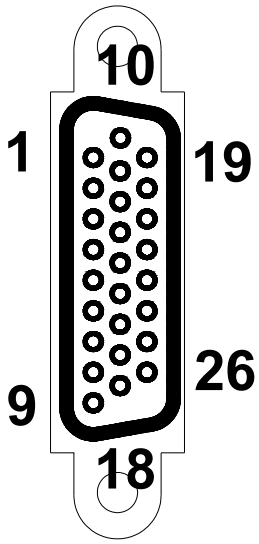
Front panel and pinout of the connectors



F. 15 Front panel and pinout of its connectors.

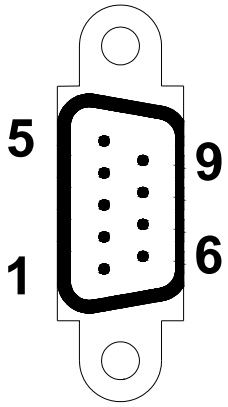
NOTE. The label 220 V AC will indicate 400 V AC on the corresponding models.

E. Input connector for motor feedback and temperature sensor.



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

F. Communications connector



Pin	Signal	Function
1	N.C.	Not connected
2	R x D	R x D (232)
3	T x D	T x D (232)
4	+ 5V	Voltage supply
5	GND	GND
	Chassis	Screws

Characteristics plate

The specs plate that comes with each FAGOR ACSD digital drive shows the following information.

FAGOR	Fagor Automation S. Coop.(Spain) AC SERVODRIVE	CE
MODEL: ACSD -16 H S.N.: 22-0309000003	INPUT : 3 x 220 V AC - 50 Hz / 60 Hz	
CTRD POT OPR CAN VAR FR 00A 01A 00A 00A PRE	Io 8 A Imáx 16 A	W: 3,8 kg

F. 16 Characteristics plate.

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

Sales reference

Codes of the sales reference of FAGOR drives.

ACSD DIGITAL DRIVE — **EX. ACSD - 05 L**

Model **ACSD**

Current (A)	Rated	Peak (0.5 s)
05	2.5	5.0
10	5.0	10.0
20	10.0	20.0
30	15.0	30.0

Supply Voltage 220 V AC

ACSD DIGITAL DRIVE — **EX. ACSD - 04 H**

Model **ACSD**

Current (A)	Rated	Peak (0.5 s)
04	2.0	4.0
08	4.0	8.0
16	8.0	16.0

Supply Voltage 400 V AC

F. 17 Sales references.

INSTALLATION

General considerations

At the motor

Remove the anti-corrosion paint of the shaft before mounting them on to the machine.

The motor may be mounted as IM B5, IM V1 and IM V3.

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

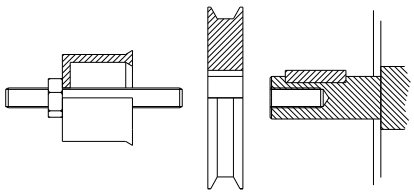
- ❑ Start the drive up (or do a reset) with the rotary switch in the “0” position.
- ❑ Mount it somewhere that is dry, clean and accessible for maintenance.

NOTE. Remember that the degree of protection is IP 64.

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

MANDATORY. 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.

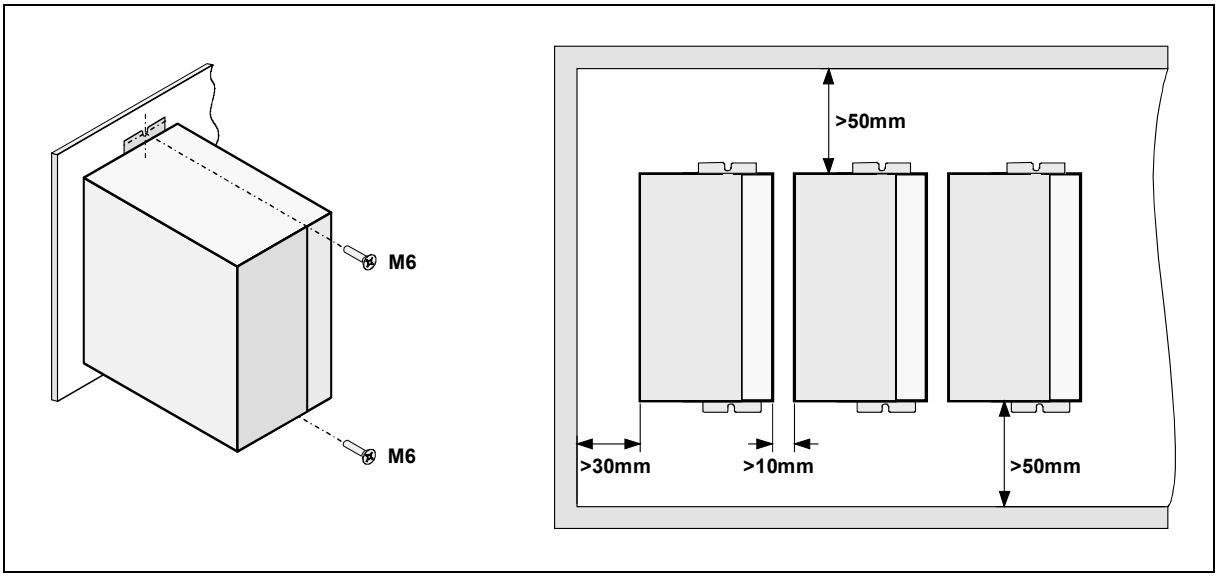


At the Drive

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

NOTE. 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 **F. 18**.



F. 18 Installation of ACSD modules.

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, to mains ground.

NOTE. Keep the signal cables away from the power cables.

Electrical connections

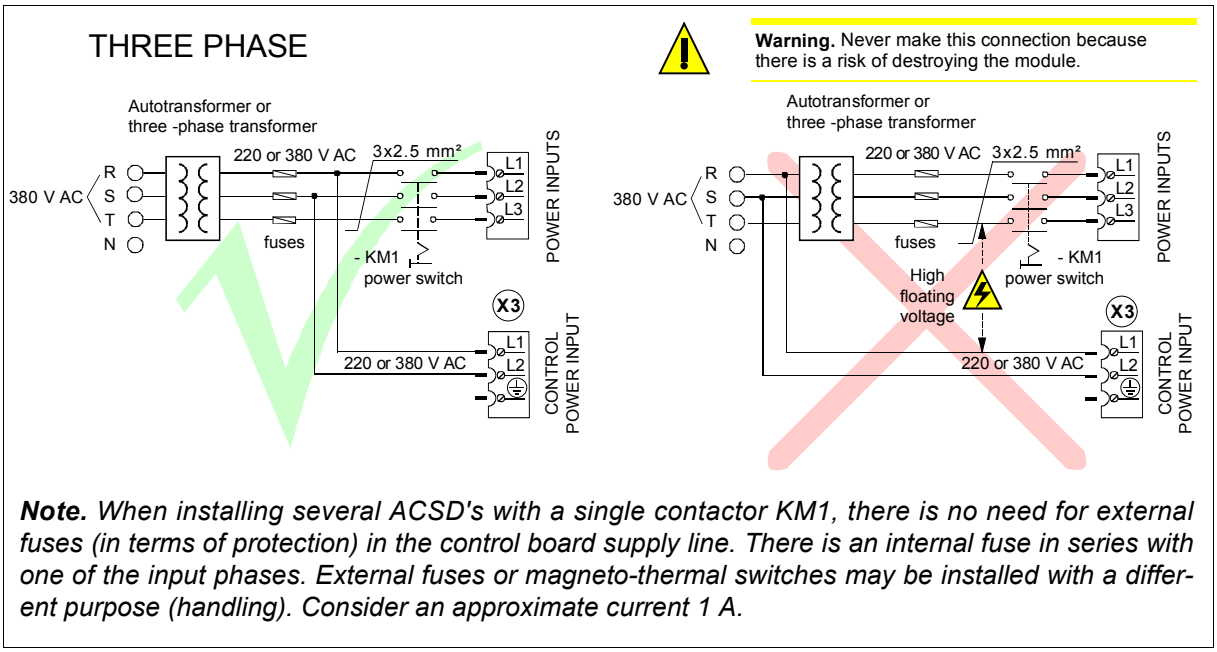
Power connection. Mains - Drive

The power supply of “ACSD-xxL” units must be three-phase 220 V AC, except in modules ACSD-05L and ACSD-10L that can also be single-phase if parameter GP16 has been properly set. ACSD-xxH units must always be powered with three-phase 400 V AC. Parameter GP16 is ignored for these models.

INFORMATION. If ACSD-20L and ACSD-30L (220 V AC) units were powered with single-phase voltage, the software would limit the current to 10 A.

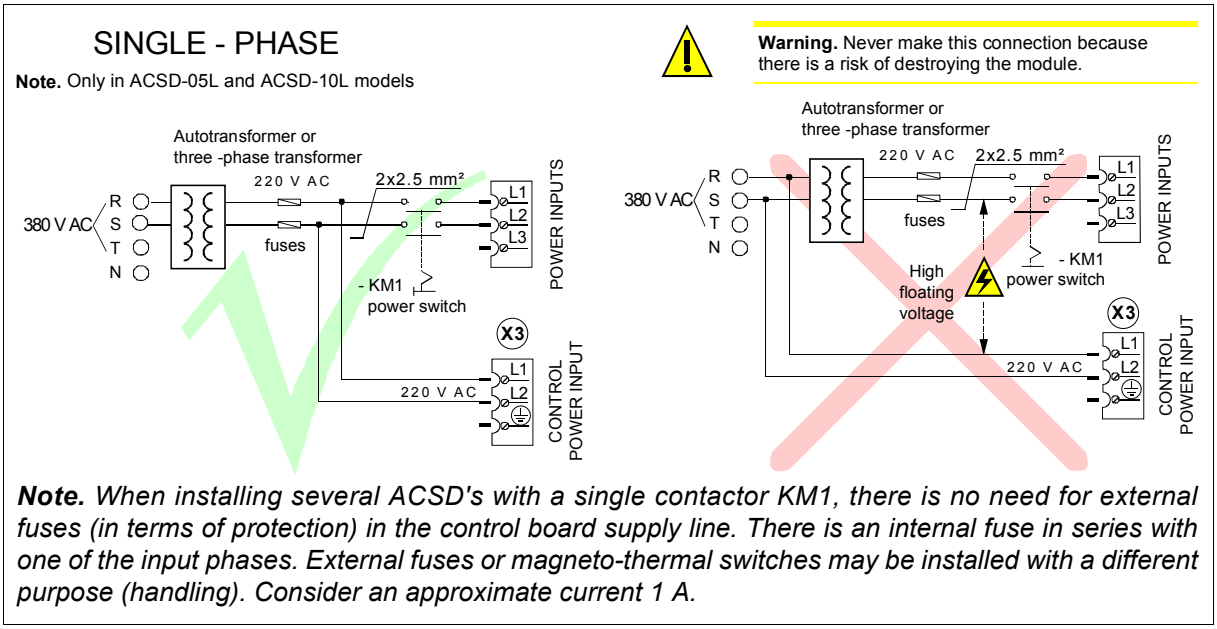
INFORMATION. Do not power ACSD-xxH (400 V AC) units with single-phase power voltage. The necessary bus voltage will never be reached.

NOTE. The use of a transformer is not a must.



Note. *When installing several ACSD's with a single contactor KM1, there is no need for external fuses (in terms of protection) in the control board supply line. There is an internal fuse in series with one of the input phases. External fuses or magneto-thermal switches may be installed with a different purpose (handling). Consider an approximate current 1 A.*

F. 19 Three-phase drive connection to mains.



Note. *When installing several ACSD's with a single contactor KM1, there is no need for external fuses (in terms of protection) in the control board supply line. There is an internal fuse in series with one of the input phases. External fuses or magneto-thermal switches may be installed with a different purpose (handling). Consider an approximate current 1 A.*

F. 20 Connection of the single-phase drive (only ACSD-05L and ACSD-10L) to mains.

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	Ipeak	Fuse
	Arms	A
ACSD-05L	05	04
ACSD-10L	10	08
ACSD-20L	20	16
ACSD-30L	30	25

Model	Ipeak	Fuse
	Arms	A
ACSD-04H	04	04
ACSD-08H	08	08
ACSD-16H	16	16

NOTE. A thermal switch may optionally replace the fuses.

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

Types of mains

Depending on the diagram of the electric energy distribution circuit, there are three types of mains: TN, TT and IT. Depending on the type of mains, the cabling in the electrical cabinet will vary considerably.

We here describe their characteristics and sample diagrams for a proper installation.

NOTE. Note that the diagrams do not show the main contactor that must be connected between the transformer or auto-transformer and the ACSD unit!

❑ TN diagram

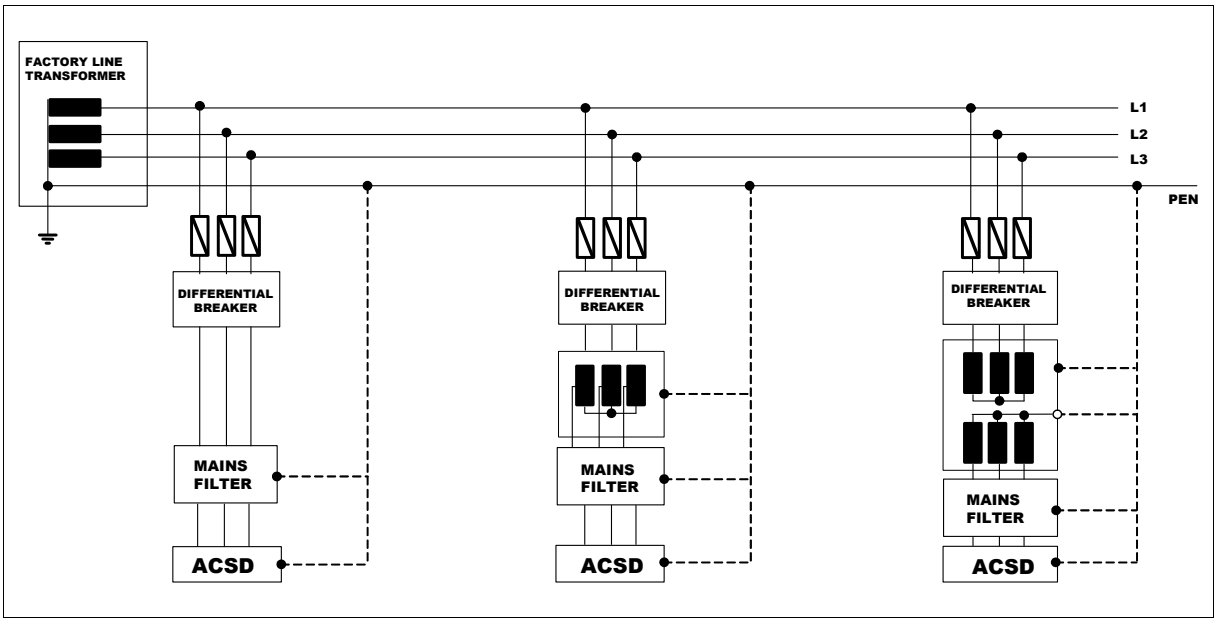
Distribution diagram that has a point directly connected to ground and the conductive parts of the installation are connected to this point through ground protection conductors. This type of mains admits loads between one or several phases and the neuter. There are three types of TN systems depending on the protection neuter and ground combination:

TN-S diagram where the neuter and the ground protection conductors are separated throughout the whole length of the system.

TN-C-S diagram where the neuter and the ground protection wire are combined in a single conductor somewhere in the system.

TN-C diagram where the neuter and the ground protection functions are combined in a single conductor throughout the system.

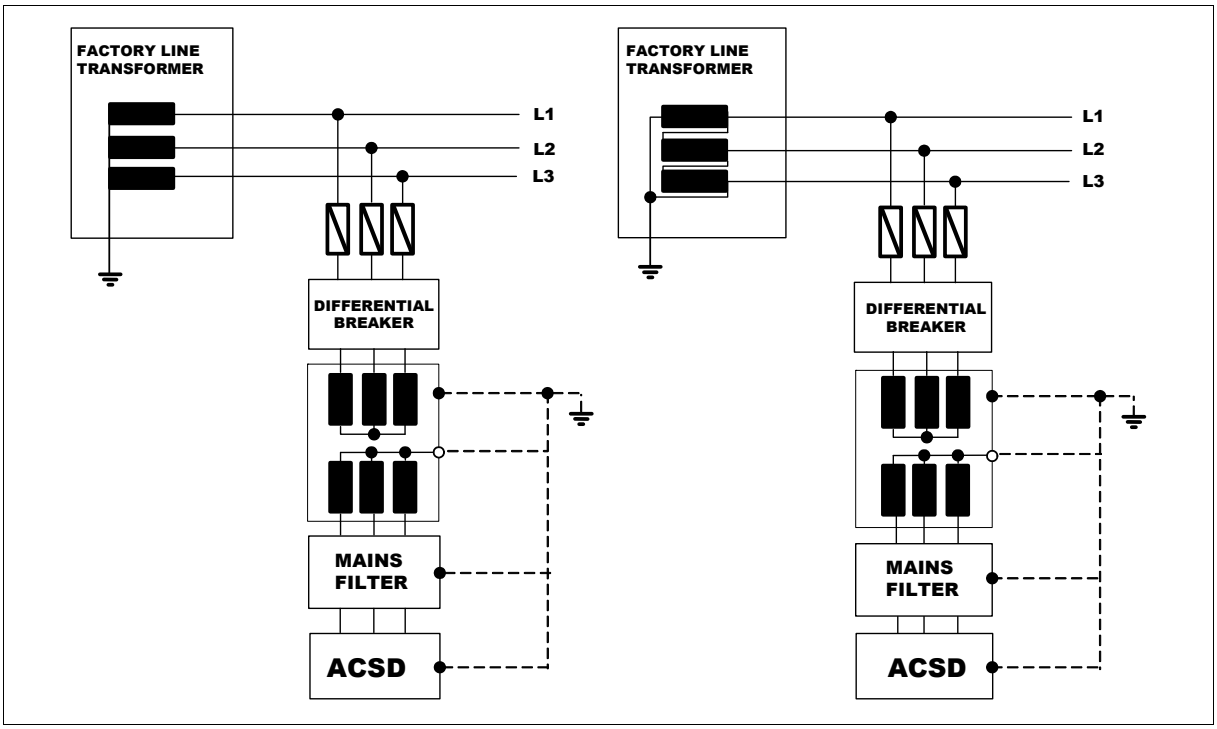
WARNING. TN type mains are the only ones to which the ACSD system can be connected either directly or through an auto-transformer.



F. 21 TN diagram.

❑ TT diagram

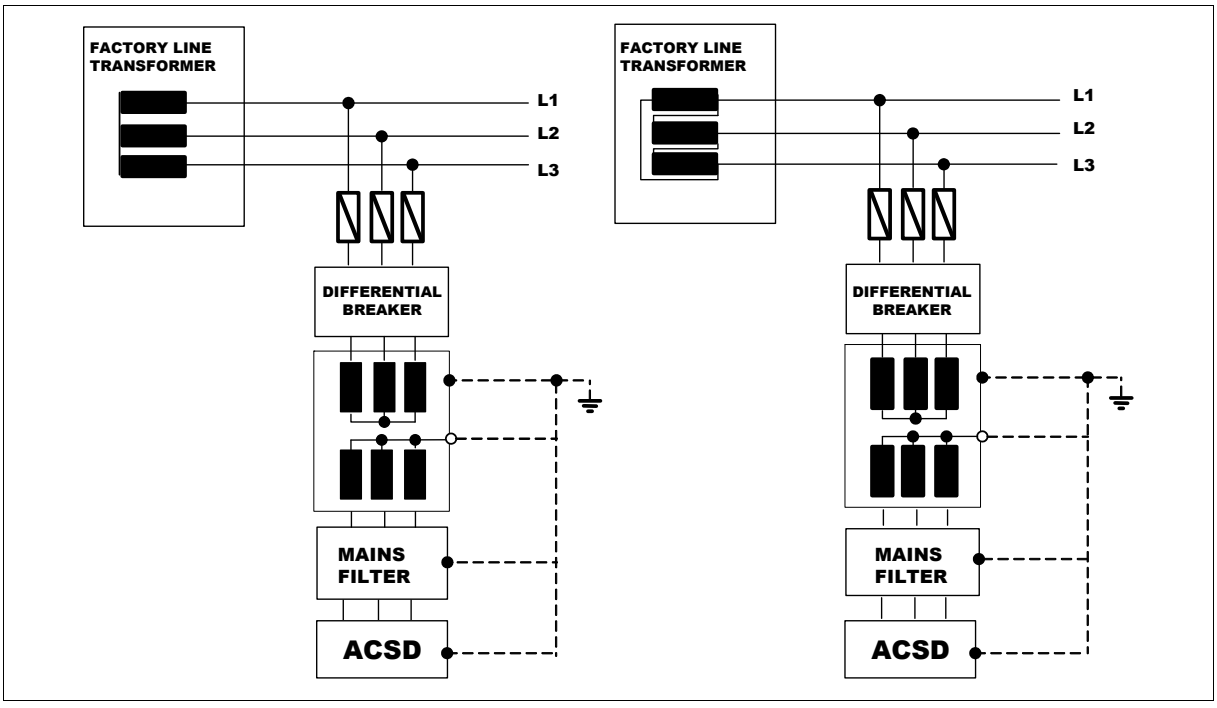
Distribution diagram that has a point directly connected to ground and the conductive parts of the installation are connected to this ground point independently from the ground electrode of the power supply system.



F. 22 TT diagram.

❑ IT diagram

Distribution diagram that does not depend on any direct connection to ground and the conductive parts of the installation are connected to ground.

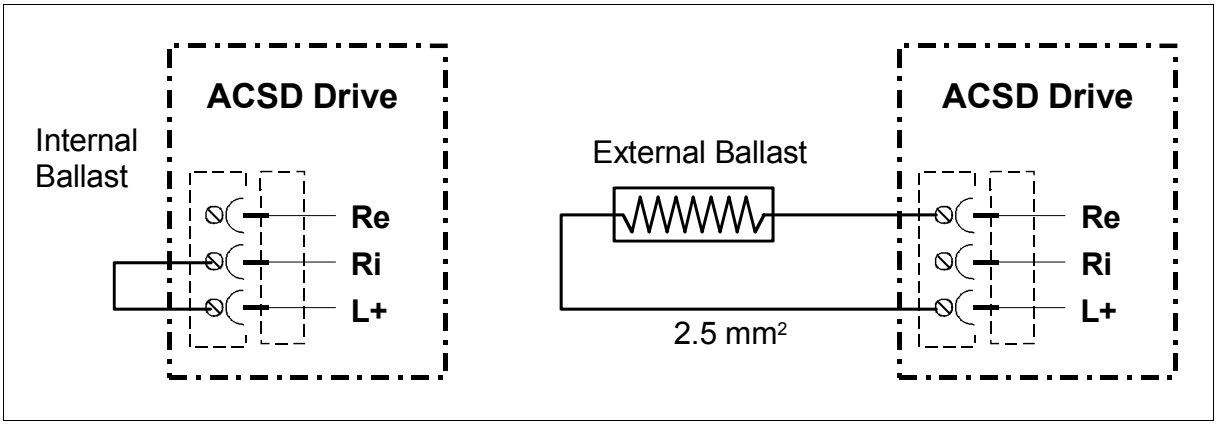


F. 23 IT diagram.

Power connection. Ballast resistor

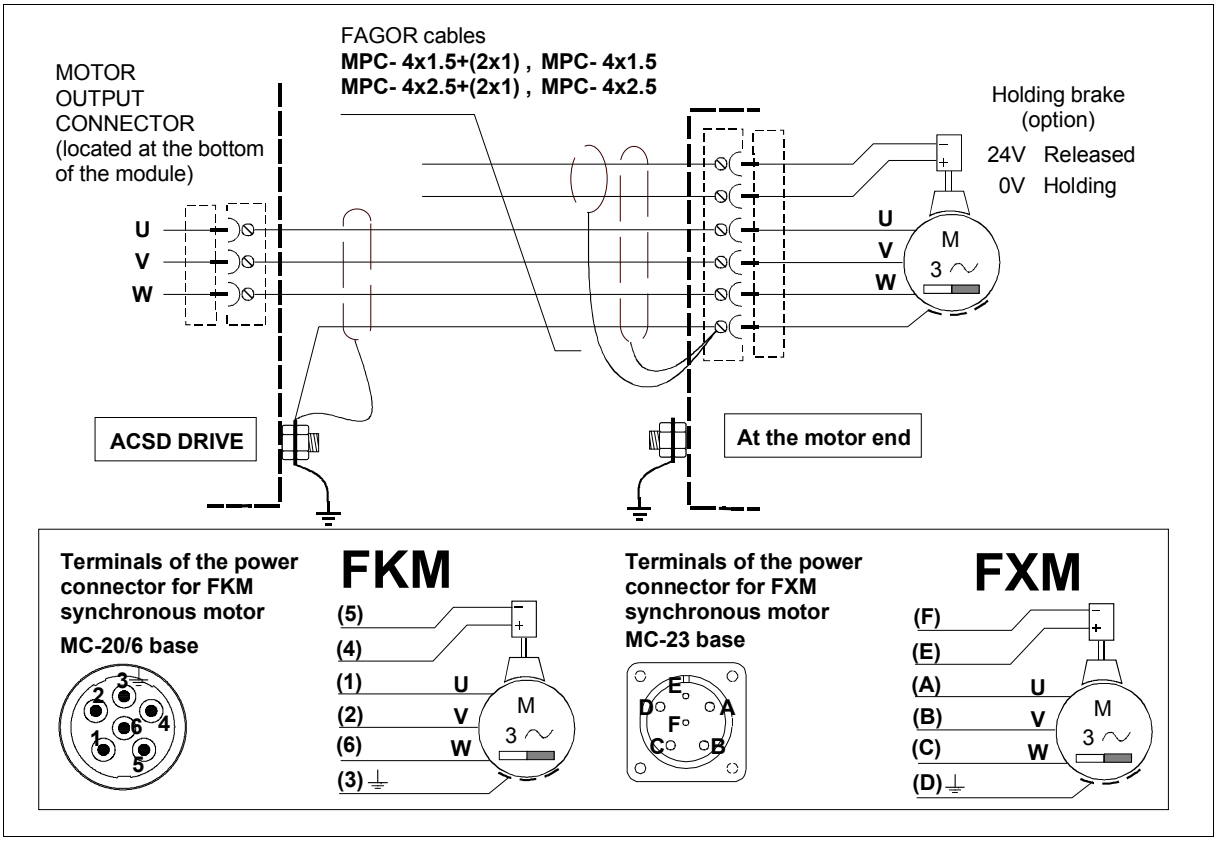
If the application requires a Ballast resistor with more than 150 W:

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



F. 24 Ballast resistor connection diagram.

Power connection. Drive - motor



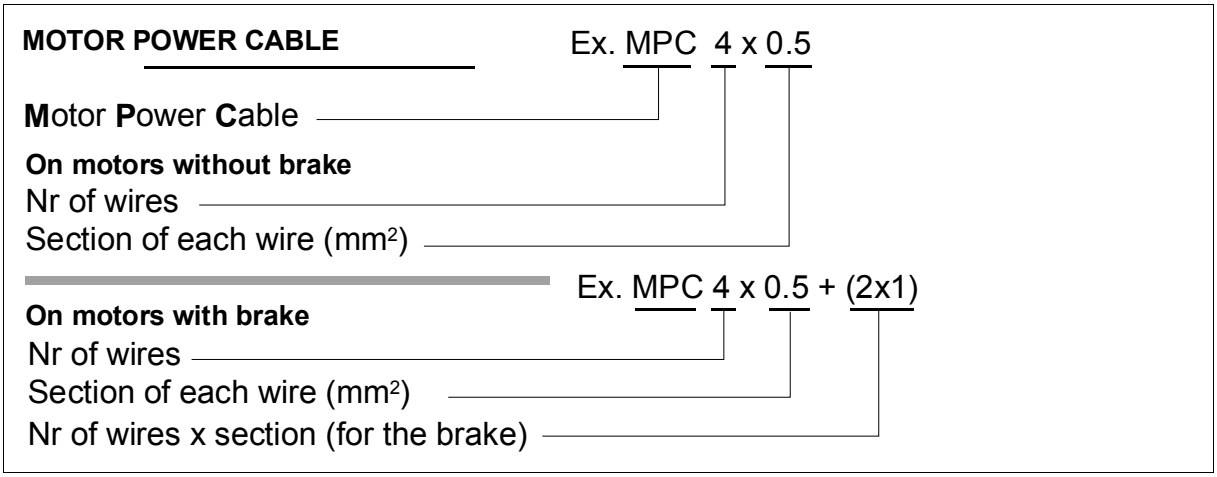
F. 25 Motor-drive power connection diagram.

Power cables

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

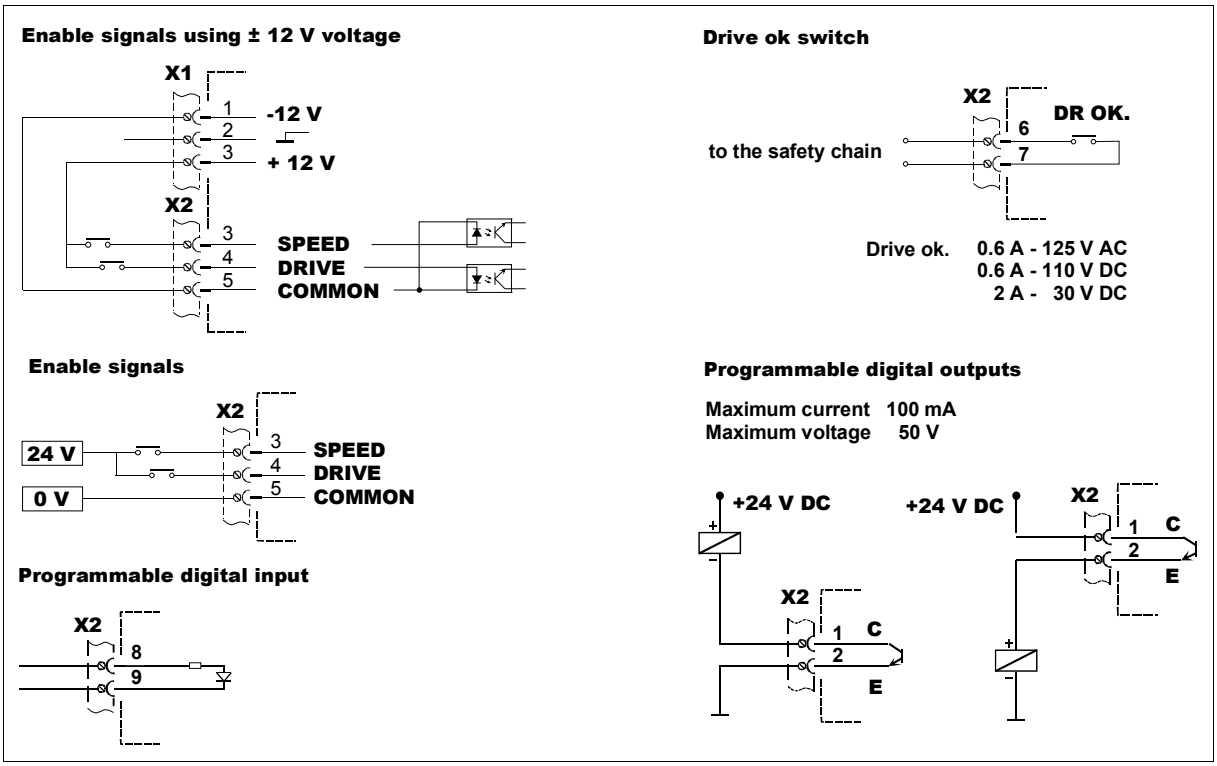
NOTE. The length of the MPC cable must be specifically ordered (in meters).

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



F. 26 Sales reference of the power cables.

Connection of the monitoring and control signals



F. 27 Connection diagrams for monitoring and control signals.

Encoder feedback connection

The signals generated by the encoder are taken to the <Motor Feedback Input> of the ACSD drive. The encoder must be mounted on to the motor shaft and cannot be installed anywhere else in the transmission chain. The encoders that can be found on the motors depending on the series are:

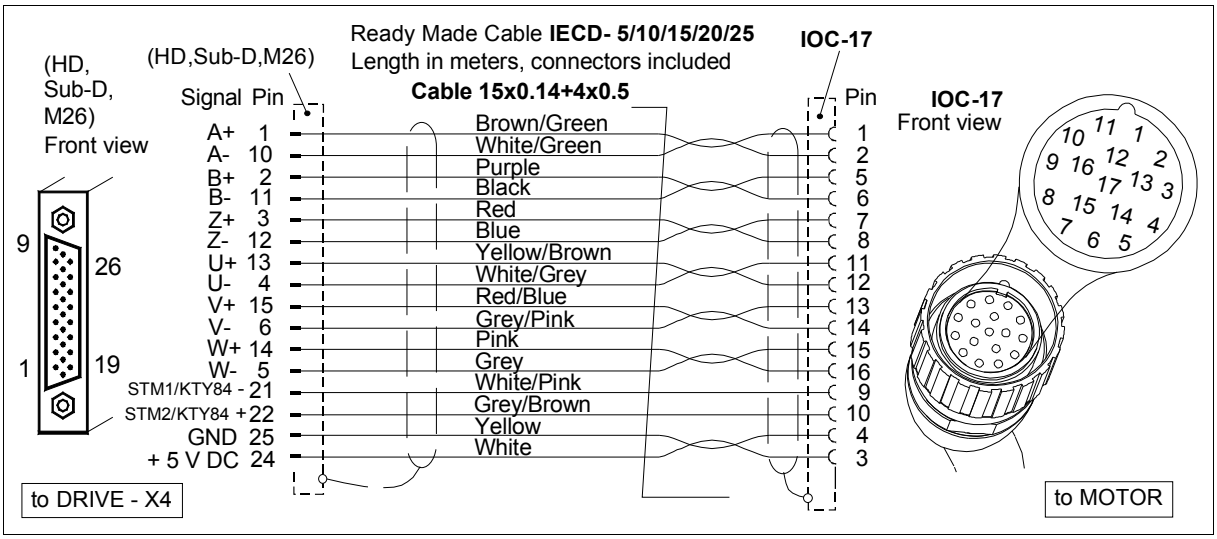
At FXM servo motors	At FKM servo motors
I0. Incremental encoder 2500 ppt	**I0.** Incremental encoder 2500 ppt
E1. SinCoder encoder 1024 ppt	**E3.** SinCos taper shaft encoder 1024 ppt
A1. SinCos multi-turn encoder 1024 ppt	**A3.** SinCos multi-turn encoder 1024 ppt

Cables

FAGOR provides these full connections (cables + connectors): IECD, EEC-SP and CAN (without connectors).

TTL encoder connecting cable, IECD

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

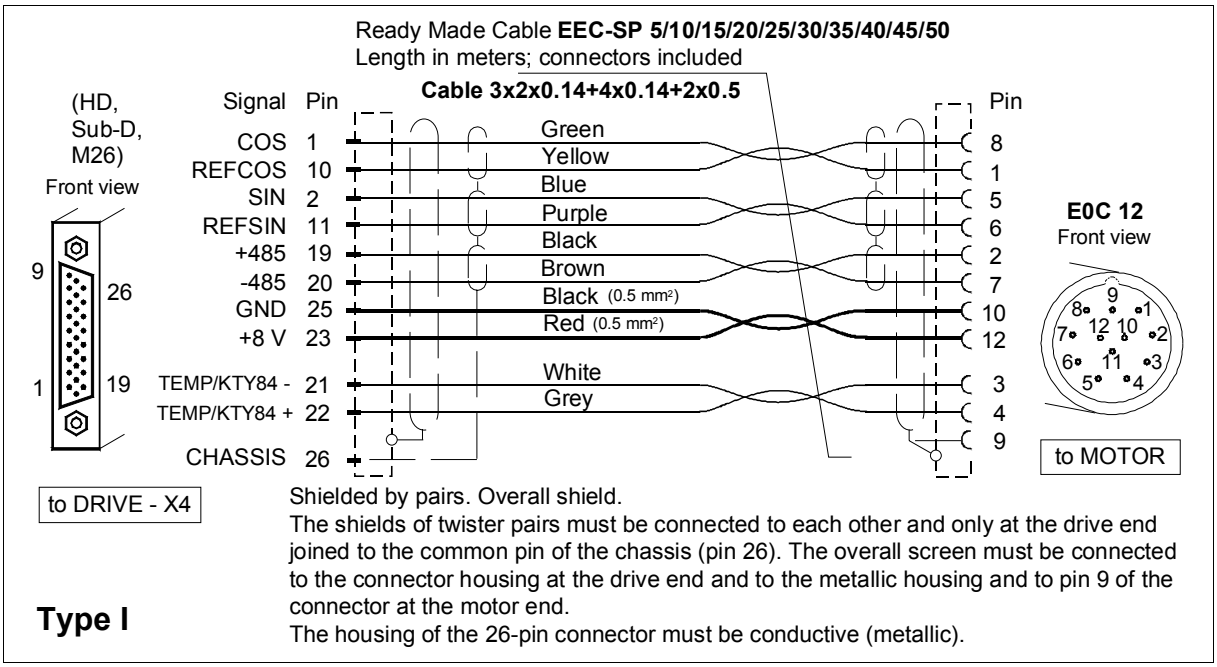


F. 28 Diagram of the IECD cable to connect the differential TTL I0 encoder.

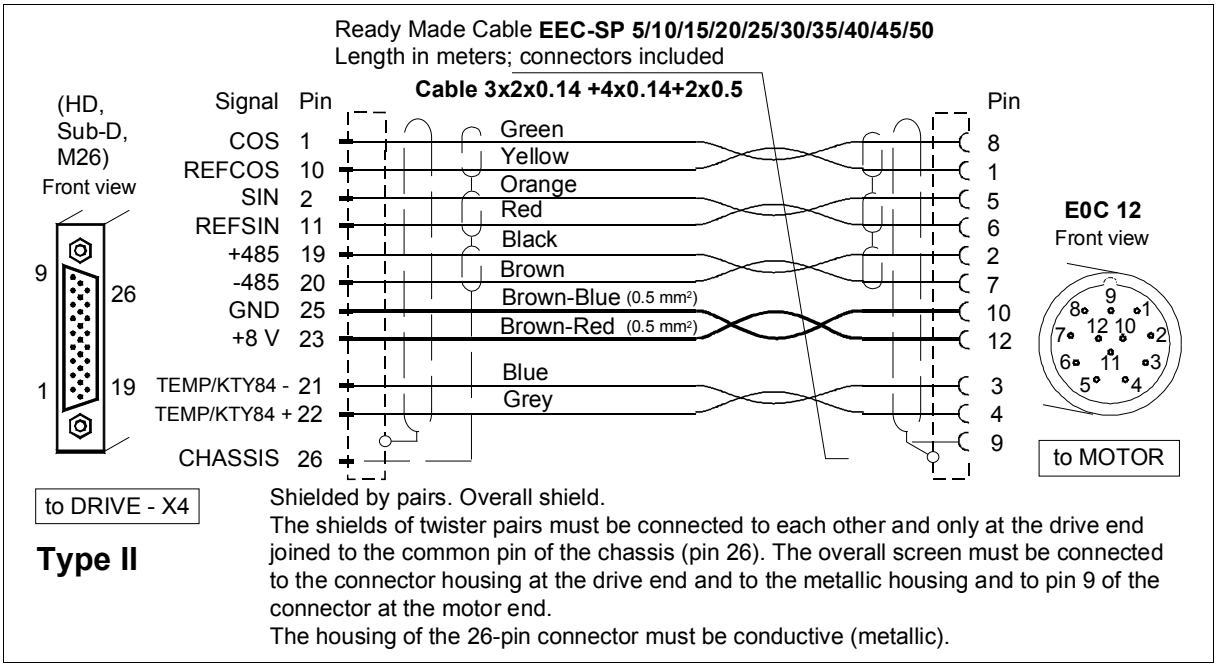
Sinusoidal encoder connecting cable, EEC-SP

The EEC-SP cable transfers the motor feedback signals from the sinusoidal encoder (Ref. A1, A3, E1, E3) to the drive. It has overall shield and shielded twisted pairs.

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



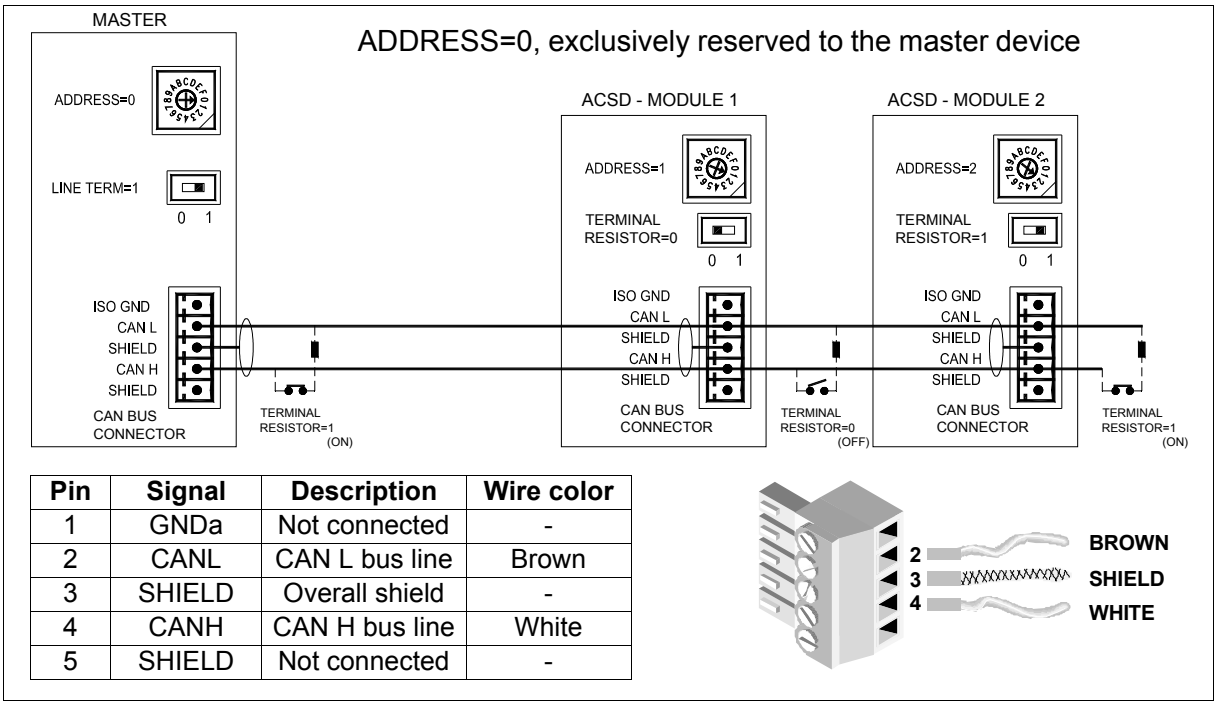
F. 29 Diagram for the sinusoidal encoder cable EEC-SP. Type I.



F. 30 Diagram for the sinusoidal encoder cable EEC-SP. Type II.

CAN field bus connection

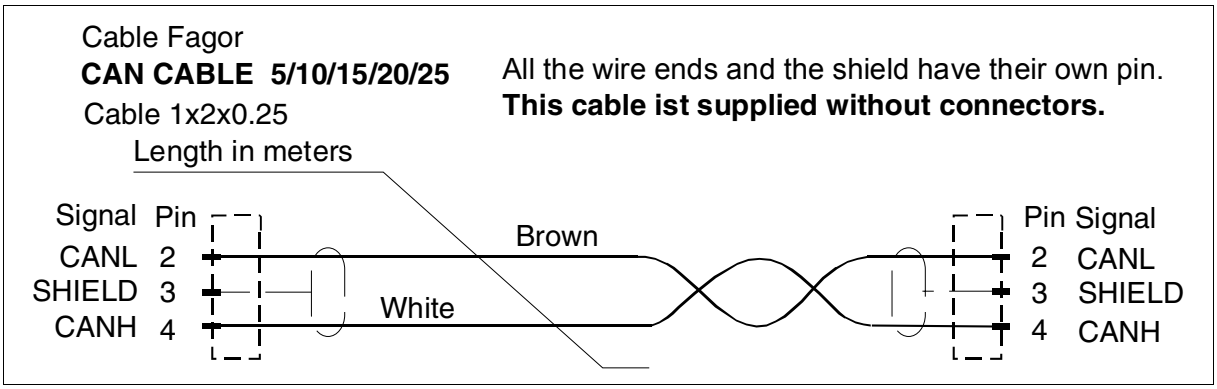
The various ACSD modules and the device acting as MASTER are inter-connected through the CAN (X4) connector that incorporates each of these modules (see its front panel) using a specific CAN cable (twisted pairs with a section of 0.25 mm and an impedance of 120 Ω). They are connected in parallel and the elements at the ends connected to the bus must have the terminating resistor activated. The 16-position (0-15) rotary switch and the speed selector switch set the address occupied by each of the modules integrated in the CAN bus.



Pin	Signal	Description	Wire color
1	GNDa	Not connected	-
2	CANL	CAN L bus line	Brown
3	SHIELD	Overall shield	-
4	CANH	CAN H bus line	White
5	SHIELD	Not connected	-

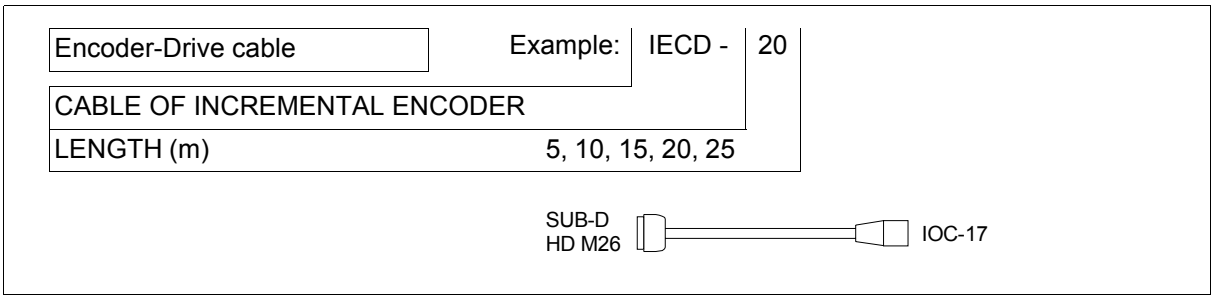
F. 31 Connection diagram for CAN communication bus.

CAN cable

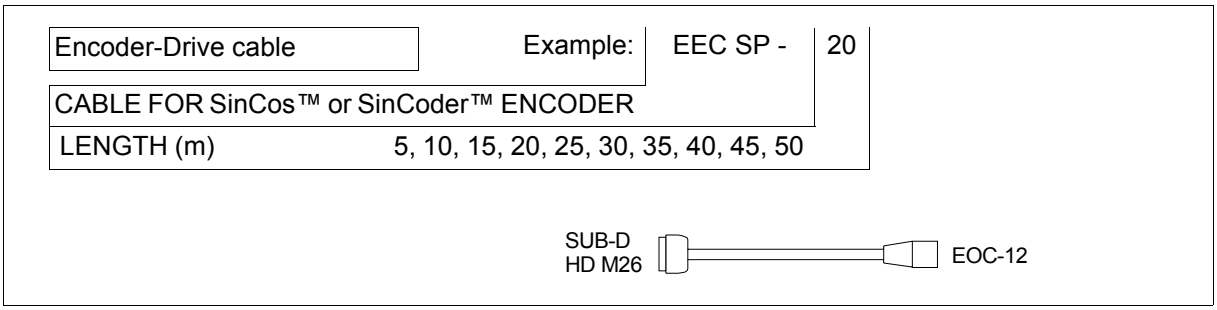


F. 32 Connection diagram of the cable for the CAN communication bus.

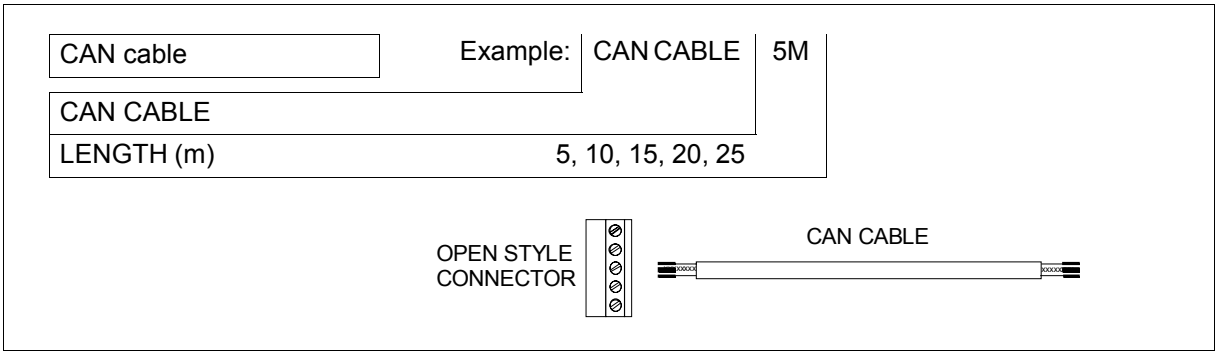
Codes of the sales reference of FAGOR cables



F. 33 Sales reference of the IECD cable.



F. 34 Sales reference of the EEC-SP cable.



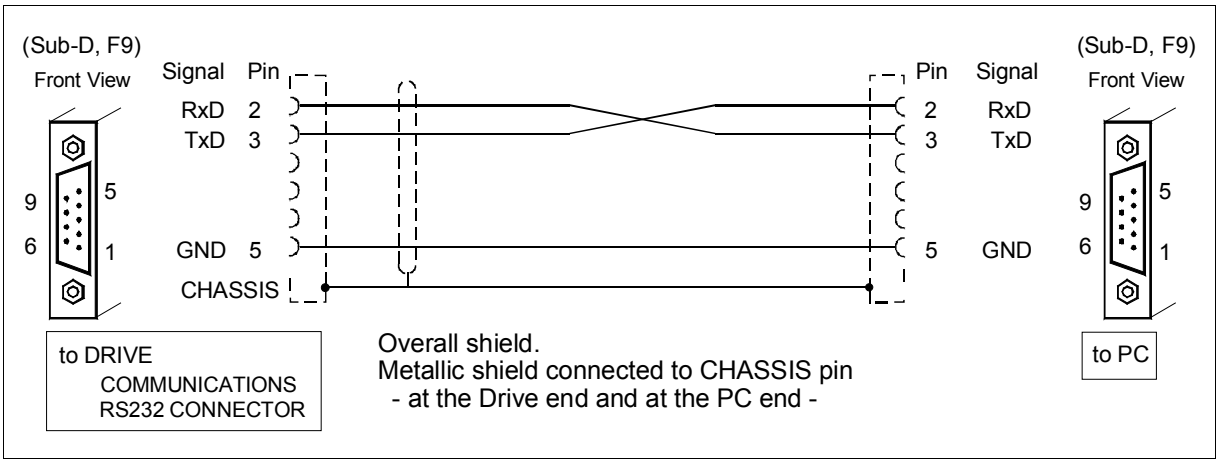
F. 35 CAN cable sales reference.

Connecting a drive to a PC. RS-232 serial line

The ACSD drive will use this RS-232 line connection only for updating the firmware.

NOTE. It is not possible to set parameters, monitor variables of the system or adjust it through the RS-232 serial line.

The connection cable is:



F. 36 RS-232 serial line connection diagram.

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.

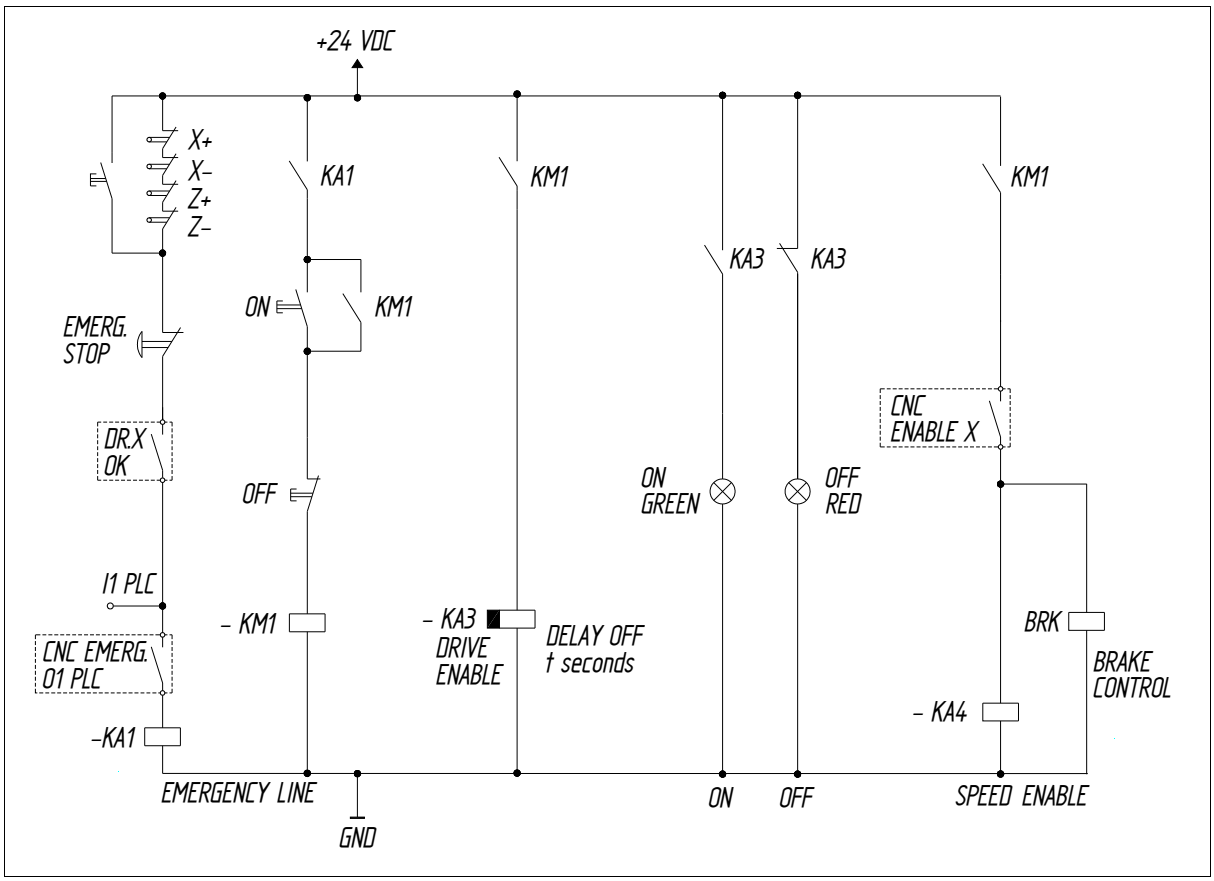
NOTE. When installing a transformer, the secondary must have a star connection and its middle point must be connected to ground.

NOTE. The use of fuses is a must.

Mains connection and maneuver diagram

The delayed disconnection of KA3 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.



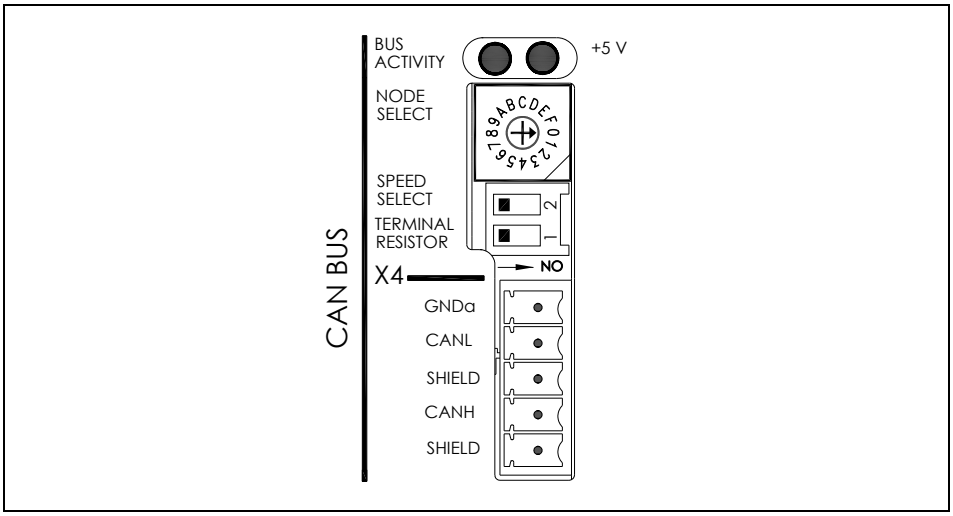
F. 37 Illustrative connection diagram of the electrical cabinet.

The system can only be initialized and adjusted using the CAN field bus (communication interface included in the ACSD drive). This process is carried out from the master device (CNC).

NOTE. Remember that the serial line can only be used to download the software to the drive.

WARNING. To update the software version of the ACSD drive, the CNC must be disconnected. If this condition is not met, the user must reset it with a **<SHIFT+RESET>** once the software has been loaded.

Initially, bear in mind the elements that make up each drive in order to configure the communication with the master device. These elements are:



TERMINAL RESISTOR. Terminating resistor

Before starting up the system, the last drive connected to the bus will be the farthest away from the master device and must be the only whose terminating resistor is activated (ON). The rest of the drives must have it turned OFF.

See figure of section - **CAN field bus connection** -

NODE SELECT. Node selector

Rotary selector that together with the **SPEED SELECT** switch is used to determine the node number assigned to the drive in the CAN bus. The node number must be selected before starting up the drive, otherwise it will only be valid after restarting and resetting the drive again. The protocol does not accept the “0” node; therefore, selecting it implies going into the “bus speed selection” sequence.

SPEED SELECT

Selector that can help the **NODE SELECT** select the node number and can confirm the communication speed of the CAN bus.

How to select the bus speed?

Proceed as follows to select the bus speed:

- ❑ Start the drive up (or do a reset) with the rotary switch in the “0” position.
- ❑ The **BUS ACTIVITY** indicating LED will blink twice quickly (50 ms on) in 1 second intervals.
- ❑ Now, select the transmission speed with the node selecting rotary switch.
- ❑ The selected speed will be effective when setting the **SPEED SELECT** selector to ON. This speed is immediately saved in the drive's E²PROM memory. The LED stops blinking and stays on and the drive stays in the “non-operative” state indefinitely.

  NOTE. Do not forget to set the **SPEED SELECT** back OFF.

- ❑ Now select the node number (attending to the status **SPEED SELECT** selector) and reset the unit to start it up properly.

Node Select	Transmission speed (rate)
0	1 MBd
1	800 kBd
2	500 kBd
3	250 kBd
4	125 kBd

Node Select	Transmission speed (rate)
5	100 kBd
6	50 kBd
7	20 kBd
8	10 kBd
others	1 MBd

NOTE. Note that if the drive is started up with the NODE SELECT switch in the 0 position, and the SPEED SELECT, the previous sequence is executed immediately hence selecting a CAN speed of 1 MBd.

How to select the node number?

The node number is set with the combination of the **NODE SELECT (NS)** switch and the **SPEED SELECT (SS)** switch according to the following formula:

Node = NS + (16 x SS) where NS can never be 0

Examples.

To assign node number 13 to a drive, the SS selector must be in the OFF position and the rotary selector NS in the D position (13 in decimal), which results from the previous formula the node value:

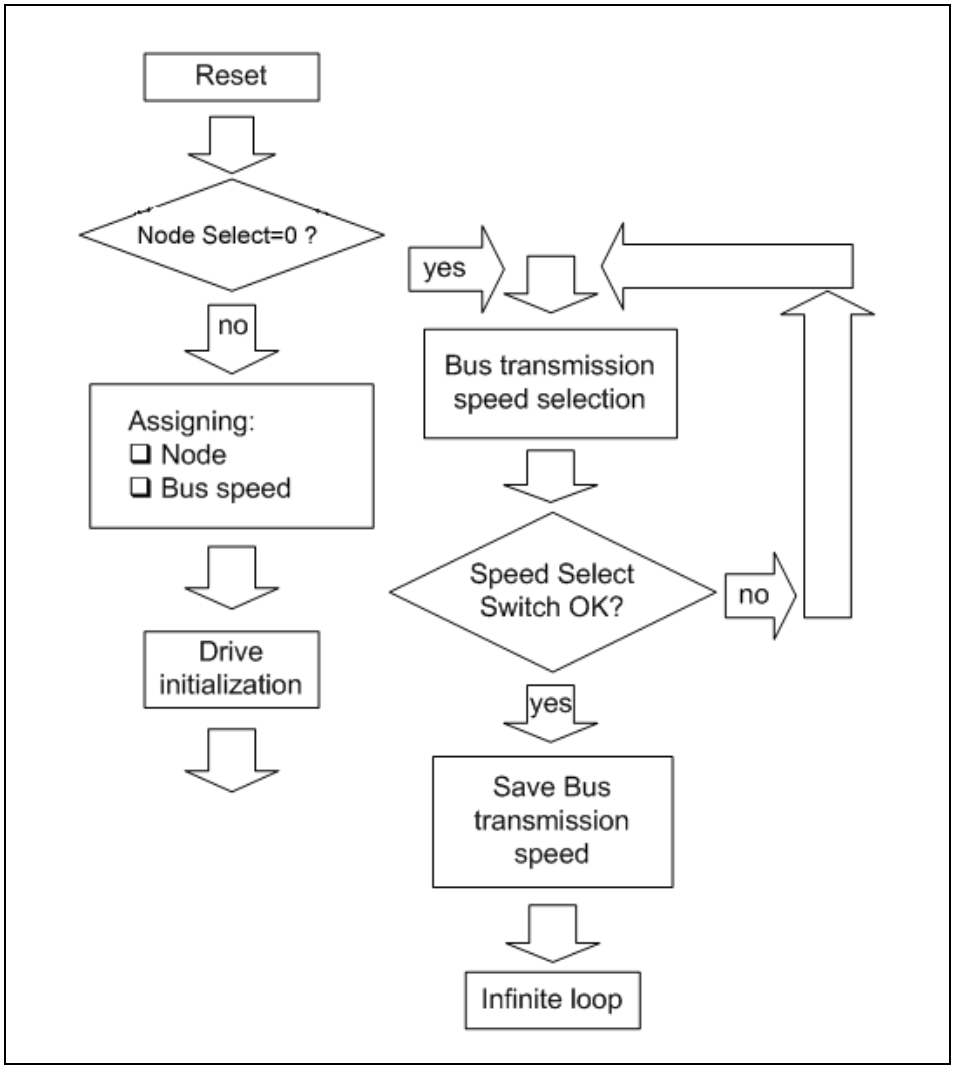
Node = 13+(16x0) = 13

To assign node number 20 to a drive, the SS switch must be in the ON position and the rotary selector NS in the 4 position, which results from the formula the node value:

Node = 4+(16x1) = 20

NOTE. Note that to select the node number between 1 and 15, the SPEED SELECT switch must be in the OFF position.

The following diagrams shows the mentioned situations:



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

BUS ACTIVITY. This LED is the only element that, without a master CAN device, allows displaying the status of the unit. This indicator light informs of the status of the CAN bus and the status of the drive.

The following table shows the different situations of the indicator light and their meanings.

Status	Meaning
OFF	**No bus** The bus is being initialized or has not been able to start up. Drive without errors.
ON	**Running** The bus is working with all its features and allows enabling the unit.
Slow blinking 200 ms ON 200 ms OFF	**Pre-running** The bus is in the parameter setting stage (asynchronous) and does not allow to enable the drive.
Fast blinking 50 ms ON 50 ms OFF	**Error** The drive is in an error state.
Double flash 50 ms ON/OFF 1 s OFF	**Speed selection** The drive has started up with the NODE SELECT switch in “0” and it is in the speed selection stage.

NOTE. A drive puts out pulses only if the BUS ACTIVITY indicator is lit, power is applied to it, the hardware enables are activated and the CNC enables it through the CAN bus.

PARAMETERS, VARIABLES & COMMANDS

The parameters, variables and commands of the drive that are shown next may be used with any device that works as master. Besides all these, there are others that may be used to communicate the drive with the CNC.

Notation

<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	Control signals	Terminal box	B
2	Current control loop	Current	C
3	Error diagnosis	Diagnosis	D
4	General of the system	General	G
5	System hardware	Hardware	H
6	Analog and digital inputs	Inputs	I
7	Temperatures and voltages	Monitoring	K
8	Motor properties	Motor	M
9	Linear configuration	Linear axis	N
10	Analog and digital outputs	Outputs	O
11	Position loop	Position	P
12	System communication	Communication	Q
13	Rotor sensor properties	Rotor	R
14	Velocity control loop	Speed	S
15	Torque and power	Torque	T

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

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

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

Definition examples:

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

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

GC1: G group, (C) Commando, (Nr) 1.

Access level. The access level is defined by the number following the ID. Hence:

- ❑ FAGOR level - 1 -
- ❑ User level - 2 -
- ❑ Basic level - 3 -

Examples of access levels:

SP10 basic: Group **S**, (P) Parameter, (Nr) 10, access level (basic)

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

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

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

Example of a modifiable variable:

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

Parameter that cannot be modified with torque. Any parameter that for any reason cannot be modified while the unit has torque will have an asterisk (*) identifying it as such next to its access level.

Example of a parameter that cannot be modified with torque:

MP1 Basic, *RW: Group M, (P) Parameter, (Nr) 1, (basic) access level, (*) not modifiable with torque, (RW) parameter (read and write).

B. Non-programmable inputs and outputs

BV14	FAGOR, RO	S32972	NotProgrammableIOs

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

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

C. Current

CP1	*FAGOR, RW	S00106	CurrentProportionalGain

Function Value of the proportional action of the current PI.

Valid values 0 ... 999.

Default value Depends on the motor-drive combination.

CP2	*FAGOR, RW	S00107	CurrentIntegralTime

Function Value of the integral action of the current PI.

Valid values 0 ... 999.

Default value Depends on the motor-drive combination.

CP20	*BASIC, RW	S33075	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, RW	S33076	CurrentCommandFilter1Type

Function Parameter in charge of disabling/enabling the current filter.

Valid values 0/1 Disable/Enable.

Default value 0 Disable.

CP31	FAGOR, RW	S33080	CurrentCommandFilter1Frequency

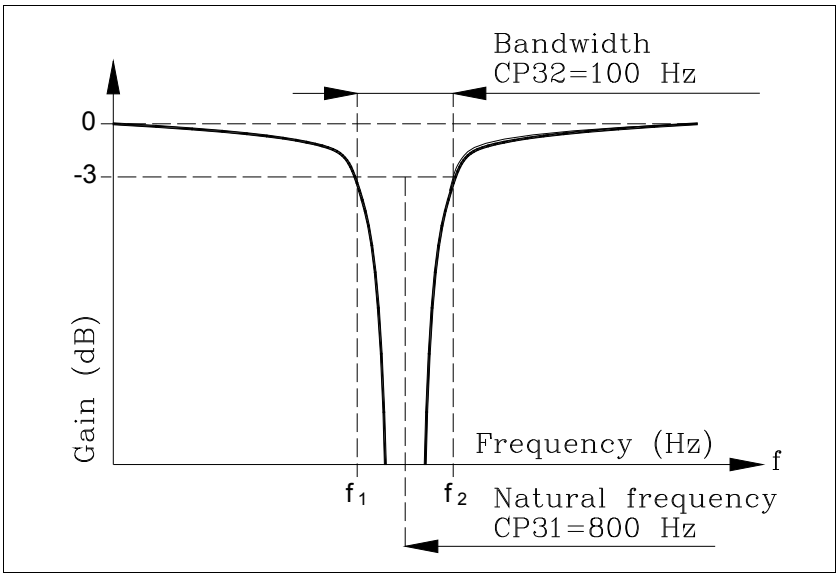
Function Sets the natural frequency in Hz of a notch filter that acts upon the current command.

Valid values 0 ... 4000 Hz.

Default value 0.

CP32	FAGOR, RW	S33081	CurrentCommandFilter1Damping

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



Valid values 0 ... 1000 Hz.

Default value 0.

CV1	USER, RO	S33077	Current1Feedback

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

Valid values - 50.00 ... 50.00 A (instant values).

CV2	USER, RO	S33078	Current2Feedback

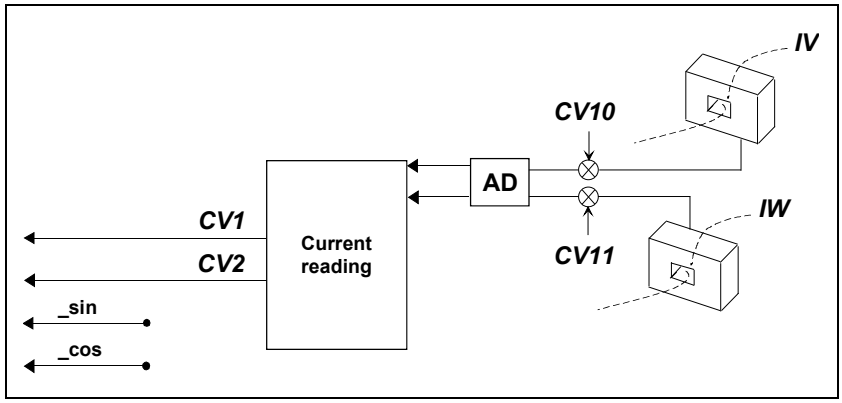
Function Display the value of the feedback of the current going through phase W.

Valid values - 50.00 ... 50.00 A (instant values)

CV3	USER, RO	S33079	CurrentFeedback

Function Display the rms current circulating through the motor.

Valid values - 50.00 ... 50.00 Arms (rms value).



CV10	FAGOR, RO	S33073	Current1Offset

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

Valid values - 2.000 ... 2.000 A (depends on the drive connected).

CV11	FAGOR, RO	S33074	Current2Offset

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

Valid values - 2.000 ... 2.000 A (depends on the drive connected).

D. Diagnosis

DV17	USER, RO	S33178	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.

DV31	FAGOR, RO	S00135	DriverStatusWord

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

DV32	FAGOR, RW	S00134	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 Nr	Function
15	Speed Enable
14	Drive Enable
13 ... 7	Reserved
6	Homing Enable
5 ... 1	Reserved
0	MasterControlWordToggleBit

DC1	USER, RW	S00099	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, RW	S33170	ClearHistoricOfErrorsCommand

Function

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

GP3	BASIC, RW	S33470	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, RO	S33468	ParameterVersion

Function This parameter represents the version of the parameter table that has been loaded at the drive.

GP9	BASIC, RW	S00207	DriveOffDelayTime

Function After the motor has stopped because the Speed Enable function has been disabled, the cancellation of the Drive Enable (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.

GP15	FAGOR, RW	S33494	AutomaticInitialization

Function When having a SinCos or SinCoder encoder it enables reading MP1 directly from the sensor and consequently loading certain drive parameter automatically.

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

Valid values 0/1 Disabled/enabled (by default).

GP16	BASIC, RW	S33495	MonoPhaseSelector

Function It enables or disables the option to feed ACSD-xxL (220 V AC) with single-phase power voltage without activating the error code for missing phase. Keep in mind that on 20 A and 30 A drives, the software will limit the current internally to 10 A.

NOTE. Not being used on ACSD-xxH (400 V AC) units. The bus voltage will not be reached when feeding these units with single-phase voltage.

Valid values 0/1 Disabled (by default)/enabled.

GV2	BASIC, RO	S00030	ManufacturerVersion

Function Displays the software version in use.

GV5	BASIC, RO	S33474	CodeChecksum

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

Valid values - 32 768 ... 32 767 (although the range goes up to 65535 because it is a 16-bit variable). The programming module can only display the 4 least significant digits. E.g. If GV5=47 234, the display of the programming module shows 7234.

GV7	BASIC, RW	S00267	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	S00140	DriveType

Function This variable informs of the drive's sales reference.

GV11	BASIC, RW	S33476	SoftReset

Function Variable that resets the unit by software.

Valid values 0 and 1 (with 1, it resets the unit).

GV16	BASIC, RO	S33484	MotorTableVersion

Function Version of the motor table.

GV75	FAGOR, RO	S00375	ErrorList

Function List of the error numbers active in the unit.

Valid values - 32 768 ... 32 767.

GC1	*BASIC, RW	S00264	BackupWorkingMemoryCommand

Function Command to execute the parameter transfer from RAM to E²PROM.

GC3	FAGOR, RW	S33498	AutophasingCommand

Function Command that lets activate the Autophasing sequence.

Procedure to follow:

- Connect the drive to the motor with the SinCos or SinCoder installed (power and feedback cables) and without a load on the shaft.
- Apply control voltage and power.
- Enable the Drive_Enable input of the drive (pin 4 of X2) and disable the Speed_Enable input (pin 3 of X2).

- Execute GC3.

The motor will start positioning and it will be completed after about 30 or 40 seconds. At this instant, the new Rho has been calculated. Its value may be displayed in the RV3 variable.

- Select MP1 and edit the motor type.
- Select RC1 and execute it to save the new values of RV3 and MP1 in the E²Prom of the encoder.

GC10	*BASIC, RW	S00262	LoadDefaultsCommand

Function Command to initialize parameters. It loads the default drive parameters, by default, for a motor that has been previously selected with parameter MP1.

H. Hardware

HV5	BASIC, RO	S33063	PLDVersion

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

I. Inputs

IP6	USER, RW	S33678	DigitalInputPolarity

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

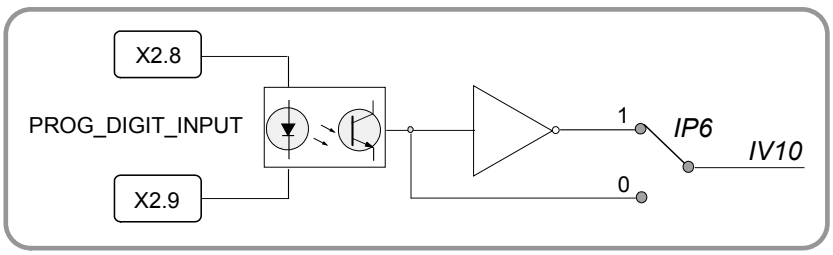
Valid values 0/1 Not inverted/inverted.

Default value 0 Not inverted.

IV10	USER, RO	S33675	DigitalInputs

Function This variable reflects the status of the digital input at pins 8 - 9 of connector X2. The status of this variable is affected by IP6.

Valid values 0 (by default) and 1.



KP3	USER, RW	S33882	ExtBallastPower

Function Contains the value of power of the external ballast resistor.
Valid values 200 ... 2 000 W.
Default value 200 W.

KP4	USER, RW	S33884	ExtBallastEnergyPulse

Function Contains the value of the energy pulse that can be dissipated by the external ballast resistor.
Valid values 200 ... 2 000 J.
Default value 200 J.

KV6	BASIC, RO	S00383	MotorTemperature

Function Motor temperature in degrees centigrade (for the time being, it is now only valid for the FKM family).
Valid values 0 ... 200 °C.

KV10	USER, RO	S33870	CoolingTemperature

Function It displays the temperature of the heatsink of the power stage.
Valid values 0 ... 200 °C.

KV32	USER, RO	S33877	I2tDrive

Function Variable internally useful to the system. It measures the internal load level of the calculation of the i²t at the drive in percentage used over the maximum.
Valid values 0 ... 100 %.

KV36	USER, RO	S33879	I2tMotor

Function Variable internally useful to the system. It measures the internal load level of the calculation of the i²t at the motor in percentage used over the maximum.
Valid values 0 ... 100 %.

KV40	USER, RO	S33883	I2tCrowbar

Function Shows the load percentage on the ballast resistor in a drive. Useful for the i²t protection of the resistor. A value greater than 100 % in this variable causes error E.314.
Valid values 0 ... 100 %.

KV41	USER, RW	S33885	BallastSelect

Function Selector that determines whether the ballast resistor is external or internal.
Valid values 0/1 External/internal.

MP1	*BASIC, RW	S00141	MotorType

Function motor identification. The limits of certain parameters depend on the value of MP1 (for example: The upper limit of SP10 is 110 % of the motor rated speed) like its default parameter initialization through GC10. See command GC10.

MP2	*FAGOR, RW	S33968	MotorTorqueConstant

Function Contains the torque constant of the synchronous motor; i.e. themotor torque according to the rms current.

Valid values 0.00 ... 10.00 Nm/Arms

Default value 10.00 Nm/Arms.

MP3	*FAGOR, RW	S00111	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 10.00 Arms.

MP24	*FAGOR, RW	S33988	MotorMomentumOfInertia

Function Motor inertia.

Valid values 0.1 ... 1 000.0 kg·cm².

Default value It depends on the motor connected.

NOTE. This parameter will be set to its default value on power-up whenever GP15 has been set to “1”.

NP1	USER, RW	S34968	LoadMomentumOfInertiaPercentage

Function Parameter that shows the relationship between the load inertia and that of the motor rotor. When calculating this ratio, bear in mind the mechanical transmission ratio between the load movement and the motor rotation.

Valid values 0.00 ... 1 000.00 %.

Default value 0.00 %.

NP116	FAGOR, RO	S00116	ResolutionOfFeedback1

Function Parameter that cannot be modified by the user that “tells” the CNC the number of pulses of the motor feedback.

Valid values 0 ... 65 535 pulses.

Default value It depends on the motor connected.

NP121	FAGOR, RW	S00121	InputRevolutions

NP122	FAGOR, RW	S00122	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 ... 65 535 turns.

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

NP123	FAGOR, RW	S00123	FeedConstant

Function It defines the gear ratio between the linear movement of the machine and the axis moving it. For example, if every turn of the leadscrew means a 4 mm displacement of the table, the value for this parameter is NP123=4. If it is a rotary axis, set NP123 = 360 (360º per turn).

Valid values 0 ... 214 748 mm.

Default value 5 000 µm (5mm per turn).

O. Analog and digital outputs

OP6	USER, RW	S34184	DigitalOutputPolarity

Function Sets the polarity (inverted or not inverted) of the digital output (pins 1 and 2 of X2).

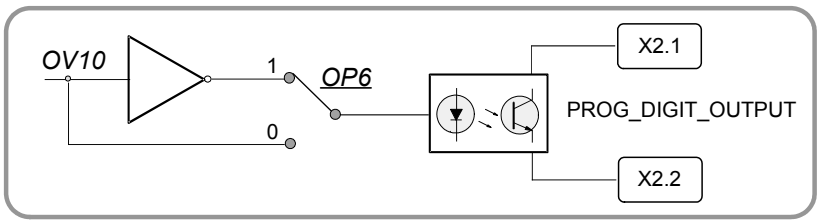
Valid values 0/1 Not inverted/inverted

Default value 0 Not inverted.

OV10	USER, RO	S34178	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 and 1.



P. Position loop

PP217	FAGOR, RW	S00348	AccelerationFeedForwardPercentage

Function It sets the how much acceleration feed-forward is applied in position control and in velocity control. It is similar to parameter ACFGAIN < P26 > of the axes of the 8055/55i CNC.

Valid values 0.0 ... 120.0 %.

Default value 0.0 %. The feed-forward effect is not applied.

PV51	FAGOR, RO	S00051	PositionFeedback1

Function Counter of the motor feedback pulses in 24.8 format that helps the CNC control the position feedback.

Valid values - 2 147 483 647 ... 2 147 483 647.

PV173	FAGOR, RO	S00173	MarkerPositionA

Function Zero coordinate “latched” (captured and maintained) by the drive.

PC146	FAGOR, RW	S00146	NCControlledHoming

Function Zero position latching command.

Q. Communication

QP1	FAGOR, RW	S00001	ControlUnitCycleTime

Function

Read parameter that indicates every how long the drives close the loop. Therefore, it defines the loop time.

NOTE. Any modification of this parameter becomes effective after RESETTING the unit.

Valid values

0 ... 10 000 µs.

Default value

4000 µs.

QP11	FAGOR, RW	S34768	CanBusSpeed

Function

It sets the transmission speed through the CAN bus. The CNC has a similar parameter. Both speeds must be the same in order to establish communication.

NOTE. Any modification of this parameter becomes effective after RESETTING the unit.

Valid values

0	1 MBd	**4**	125 kBd	**8**	10 kBd
1	800 kBd	**5**	100 kBd	**others**	1 MBd
2	500 kBd	**6**	50 kBd		
3	250 kBd	**7**	20 kBd		

Default value

0 ➔ transmission speed = 1MBd.

QP17	BASIC, RW	S34788	CanOpenBorder

Function

Variable that contains a numerical data in 16-bit binary code that may be used to activate or deactivate, bit by bit, the different specific controls implemented in the unit to work with the FAGOR CNC.

Set it to 0/1 to activate/deactivate the control with FAGOR CNC's.

Bit Nr	Meaning
15, ..., 7	Reserved
6	Position latch, cyclic, thorough and anticipated to the SYNC message
5	The drive can only be enabled if it is in running (operative) state.
4	Internal interpolation between velocity commands
3	Special behavior in case of errors
2	Thorough control of the jitter of the SYNC message
1	Thorough control of the arrival of the SYNC message
0	Control of the “toggle” bit of the control word DV32

Default value

With Fagor CNC as master device	Set all the bits to 0.
With another master device	It is recommended to set all the bits to 1, except bit 5 to 0.

QV22	FAGOR, RO	S00022	IDNListOfInvalidOperationDataForCP3

Function Variable containing the parameters that are readjusted by the drive when it issues an “error E.502: incompatible parameters”. The parameters are listed by their bus identifier.

Valid values Any parameter bus identifier.

QV30	FAGOR, RO	S33495	FiberDistErrCounter

Function This variable may be used to diagnose CAN problems. It is an error counter that indicates the number of times a distortion error has occurred in the CAN communication.

Valid values 0 ... 65 535.

QV96	*BASIC, RO	S00096	SlaveArrangement

Función This variable indicates the node number assigned to the drive.

Valid values 1 ... 127.

QV190	FAGOR, RO	S34779	CanBusSyncJitter

Function This variable may be used to diagnose CAN problems. It reflects the oscillation of the synchronism messages with respect to the internal time base (clock) of the drive (in clock tick, 25 ns).

Valid values - 1 000 ... 1 000.

R. Rotor sensor

RP1	FAGOR, RW	S34268	FeedbackSineGain
RP2	FAGOR, RW	S34269	FeedbackCosineGain

Function Compensation (proportional gain mode) of the amplitude of the sine/cosine signal that goes from the motor feedback to the drive. Entering 4 096 is the same as multiplying by 1. To assign a gain of 1.5 to the sine signal, set RP1 to 6 144 (= 4 096 x 1.5).

Valid values 0 ➔ 0 % ... 8 192 ➔ 200 %.

Default value 4 096 ➔ 100 %.

RP3	FAGOR, RW	S34270	FeedbackSineOffset

RP4	FAGOR, RW	S34271	FeedbackCosineOffset

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

Valid values - 2 000 ... 2 000.

Default value 0.

RP20	USER, RW	S34305	StegmanABLevelSense

Function Motor feedback failure protection sensitivity adjustment. See E.605.

Valid values 30 ... 100 %.

Default value 100 %.

RP77	FAGOR, RW	S00277	PositionFeedback1Type

Function Type of encoder installed on the motor.

Valid values - 32 768 ... 32 767.

Default value 0.

RV1	USER, RO	S34274	FeedbackSine

RV2	USER, RO	S34275	FeedbackCosine

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

Valid values - 512 ... 511.

RV3	FAGOR, RO	S34276	FeedbackRhoCorrection

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

Valid values 0 ... 6 553.

RC1	*FAGOR, RW	S34281	EncoderParameterStoreCommand

Function Command that could be used to store the content of MP1 and RV3 in the E²PROM of the SinCos or SinCoder encoder.

S. Speed

SP1	BASIC, RW	S00100	VelocityProportionalGain

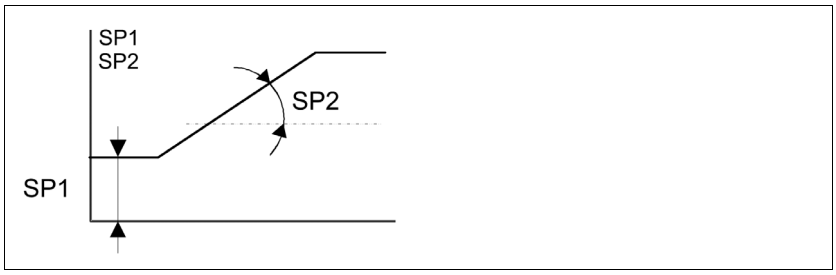
SP2	BASIC, RW	S00101	VelocityIntegralTime

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.

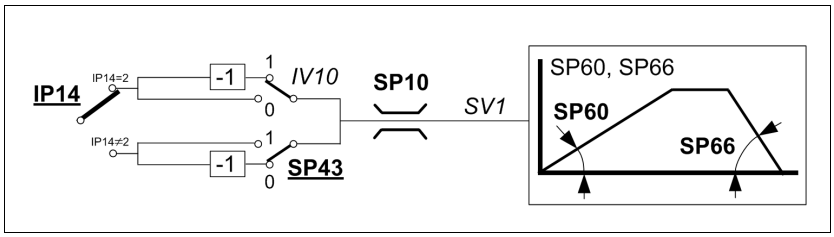


SP10	BASIC, RW	S00091	VelocityLimit

Function Maximum velocity limit for SV7 (VelocityCommandFinal).

Valid values 0 ... 110 % of the motor rated speed in rpm.

Default value 1 000 rpm.



SP42	USER, RW	S00124	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 rpm.

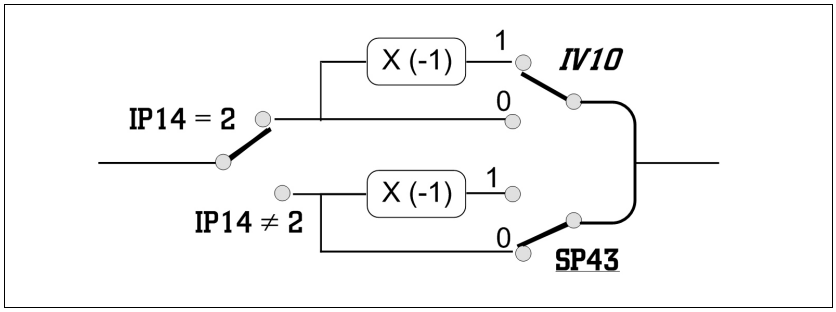
Default value 20 rpm.

SP43	BASIC, RW	S00043	VelocityPolarityParameters

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

Valid values 0/1 Not inverted/inverted.

Default value 0 Not inverted.

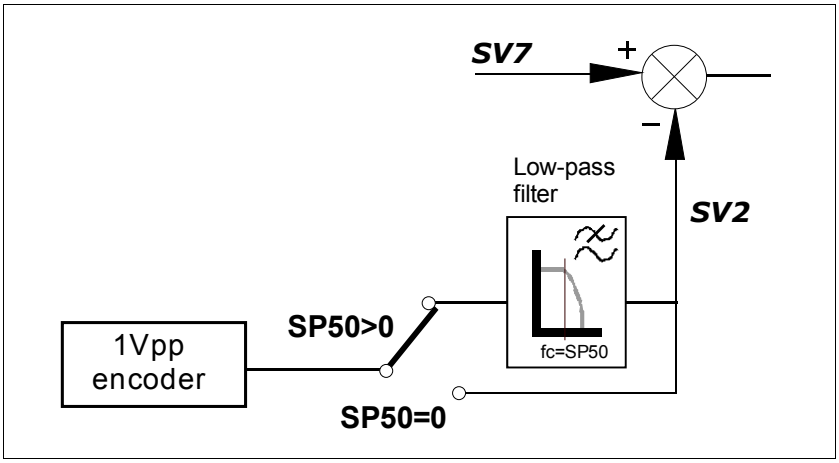


SP50	BASIC, RW	S34782	VelocityFeedbackFilterFrequency

Function Cutoff frequency of the first-order low-pass filter after the velocity feedback.

Valid values 0 (the filter is not applied) ... 4 000 Hz.

Default value 800 Hz.

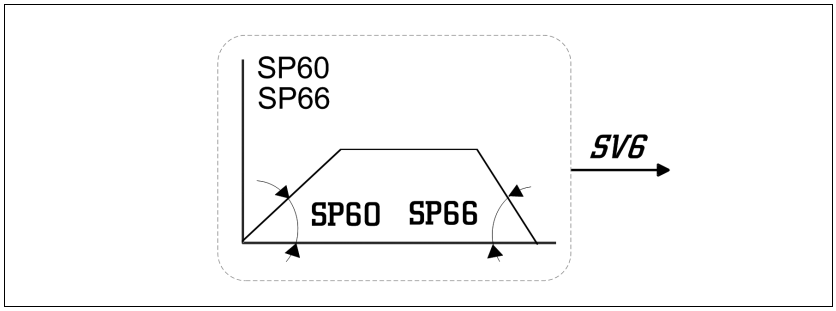


SP60	BASIC, RW	S00138	AccelerationLimit

Function Determines the value of the acceleration ramp applied to the velocity command. Setting it with a zero value means that no ramps will be applied.

Valid values 0.0 ... 400.0 rpm/ms.

Default value 0.0 rpm/ms.

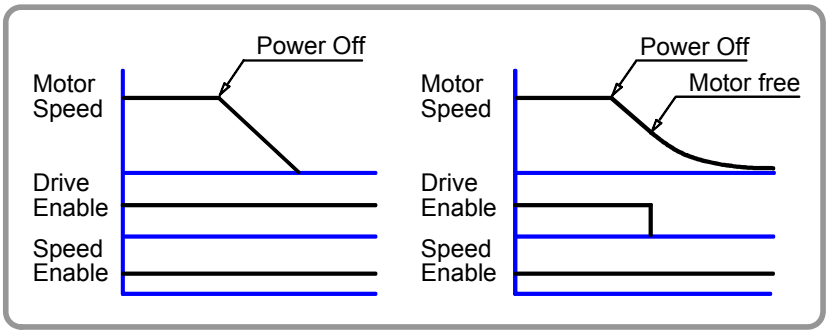


SP65	BASIC, RW	S34377	EmergencyAcceleration

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.

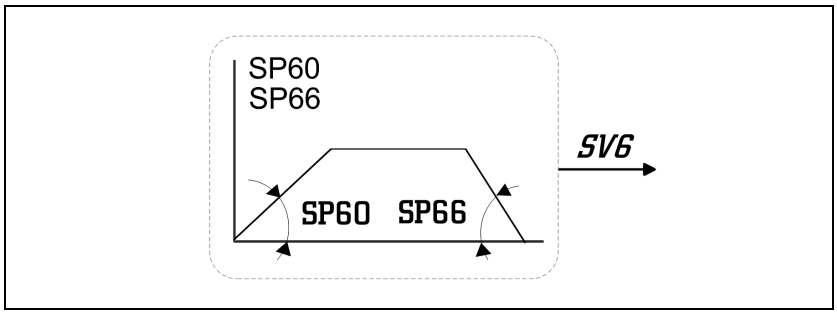


Valid values 0.0 (by default), ..., 400.0 rpm/ms.

SP66	BASIC, RW	S34386	VelocityDecelerationTime

Function Determines the value of the deceleration ramp applied to the velocity command. Setting it with a zero value means that no ramps will be applied.

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



SV1	BASIC, RW	S00036	VelocityCommand

Function Velocity command after the SP45 selector.

Valid values - 6 000.0000 ... 6 000.0000 rpm.

SV2	BASIC, RO	S00040	VelocityFeedback

Function Velocity feedback.

Valid values - 6 000.0000 ... 6 000.0000 rpm.

SV6	BASIC, RO	S34390	VelocityCommandAfterFilters

Function Velocity command after applying limits, ramps, etc.

Valid values - 6 000.0000 ... 6 000.0000 rpm.

SV7	BASIC, RO	S34380	VelocityCommandFinal

Function Final velocity command applied to the loop.

Valid values - 6 000.0000 ... 6 000.0000 rpm.

TP10	USER, RW	S34670	ConstantPositiveTorqueCompensation

Function Constant friction compensation in the positive direction of the velocity. It is a constant value for all the positive reference speeds. See the figures later on.

Valid values 0.0 (by default), ..., 100.0 Nm.

TP11	USER, RW	S34671	ConstantNegativeTorqueCompensation

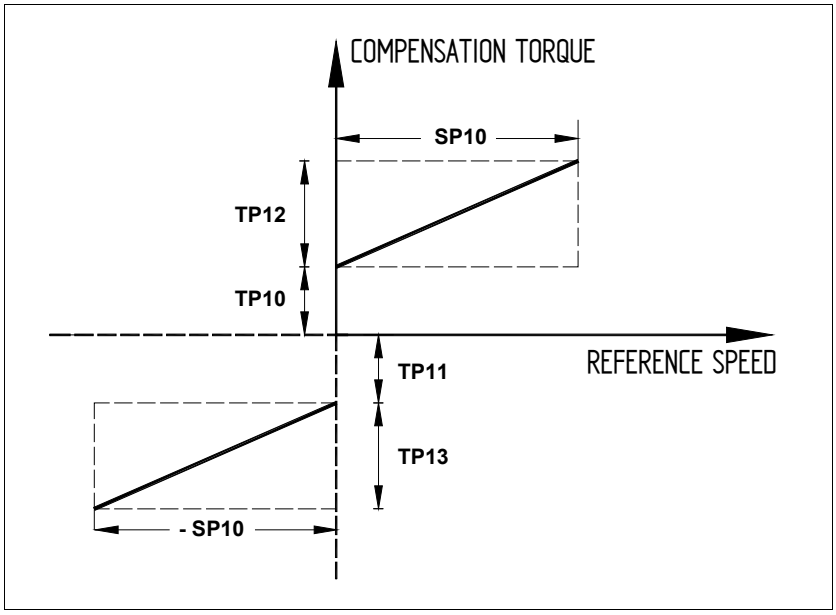
Function Constant friction compensation in the negative direction of the velocity. It is a constant value for all the negative reference speeds. See the figure further below.

Valid values 0.0 (by default), ..., 100.0 Nm.

TP12	USER, RW	S34672	DynamicPositiveTorqueCompensation

Function Dynamic friction compensation in the positive direction of the velocity. It is the value of the compensation with the reference speed equal to SP10. It is directly proportional to other positive reference speeds. See the figure further below.

Valid values 0.0 (by default), ..., 100.0 Nm.



TP13	USER, RW	S34673	DynamicNegativeTorqueCompensation

Function Dynamic friction compensation in the negative direction of the velocity. It is the value of the compensation with the reference speed equal to - SP10. It is directly proportional to other negative reference speeds. It is set as an absolute value, i.e. in positive, although the compensation has a negative value. See the figure further up.

Valid values 0.0 (by default), ..., 100.0 Nm.

TP14	USER, RW	S34676	TorqueCompensationTimeConstant

Function

Time constant of the torque compensation. Before applying it, it is filtered with a low-pass filter to improve the friction behavior in velocity direction changes.

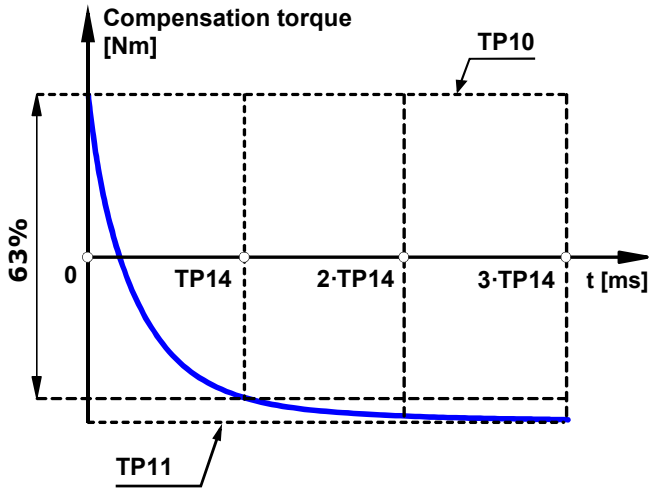
The constant friction suddenly changes when changing the sign of the reference speed. The filters “smoothes” the compensation torque preventing jerks in the system when reversing the moving direction and better modeling the behavior of friction.

NOTE. With TP14=0, all the friction compensations are canceled.

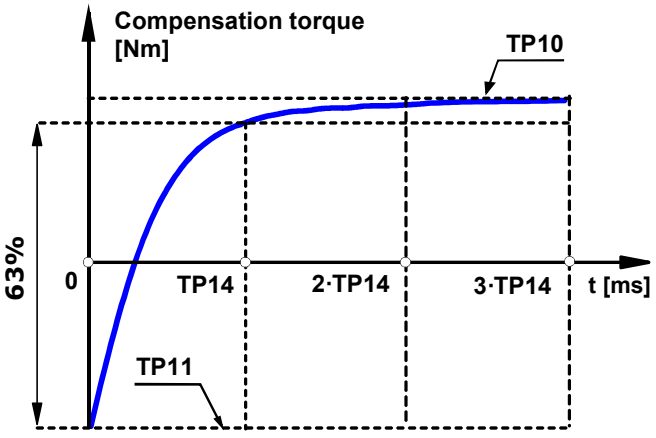
Valid values

0.0 (by default), ..., 2 000.0 ms.

Torque compensation when going from a positive speed value to a negative speed value.



Torque compensation when going from a negative speed value to a positive speed value.



Note that between:
0 and TP14 it sets 63% of torque compensation
0 and 2xTP14 it sets 87% of torque compensation
0 and 3xTP14 it sets 95% of torque compensation

TP15	USER, RW	S34677	TorqueCompensationSpeedHysteresis

Function Amplitude of the hysteresis in friction torque compensation.

NOTE. With TP15=0, the drive internally sets a fixed Hysteresis amplitude of about SP10 rpm /10 000 to compensate the friction torque. Remember that SP10 is the maximum speed of the application; therefore, it will be set to at least 0.2000 rpm which corresponds to a motor of 2 000 rpm.

Valid values 0.2000 ... 1 000.0000 rpm.

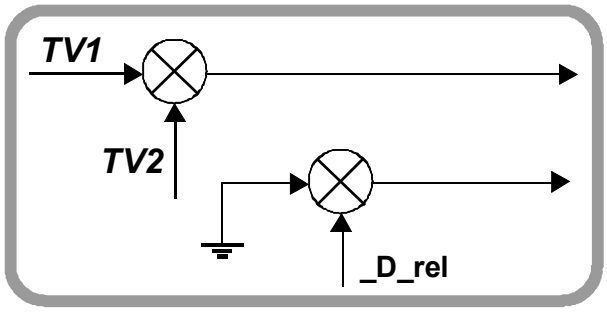
Default value 0.0000 rpm.

TV1	USER, RO	S00080	TorqueCommand

TV2	USER, RO	S00084	TorqueFeedback

Function Displays the values of the command and torque feedback.

Valid values - 99.9 ... 99.9 Nm.



TV4	USER, RO	S34380	SpeedIntegralAction

Function Output of the velocity PI integrator. When the acceleration is not extremely high, it is the same as the friction torque. When compensating for friction, the value of this variable must be reduced to near zero.

Valid values - 1 000.0 ... 1 000.0 Nm.

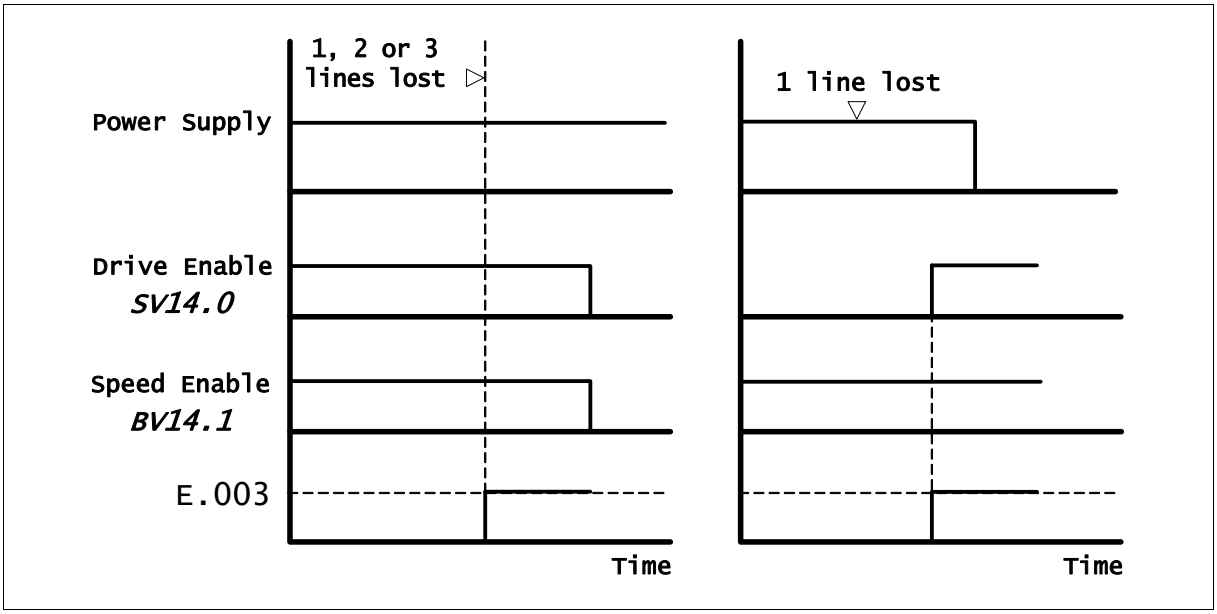
ERROR CODES

E.001	Internal	E.001

Contact Fagor Automation.

E.003	With torque, there is a drop at the power bus	E.003

Probably one of the three-phase lines has dropped or a drive has failed. Verify that the lines and the drives are in good condition and restart the system.



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

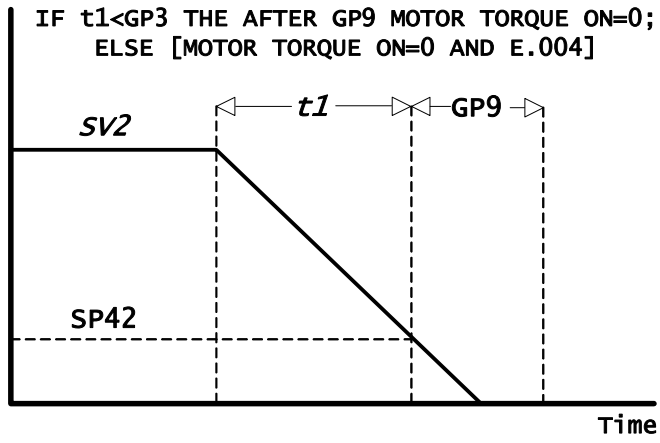
An attempt has been made to stop the motor by canceling **Speed Enable**. The system has tried to stop the motor at full torque, but it has not been able to stop it in the time frame set by parameter GP3 (**StoppingTimeout** = maximum time allowed for braking, before considering the error for being unable to stop it in the set time) or the parameter that determines when the motor is considered to be stopped (SP42) **Minimum velocity threshold**, is too small. Bear in mind that zero speed (total lack of velocity) does not exist, there is always a minimum amount of speed noise due to feedback.

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; hence, increase the value of this parameter.

The module is performing poorly and is unable to stop the motor. The module may be defective.



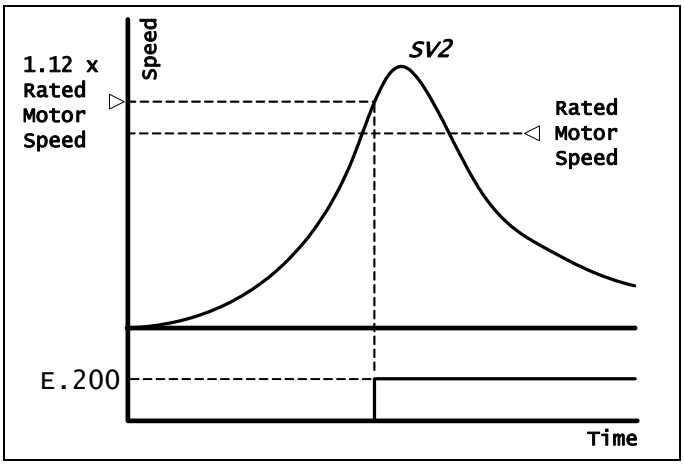
E.106 Extreme temperature at the heatsink (of the IGBT's)

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

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.200 Overspeed



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

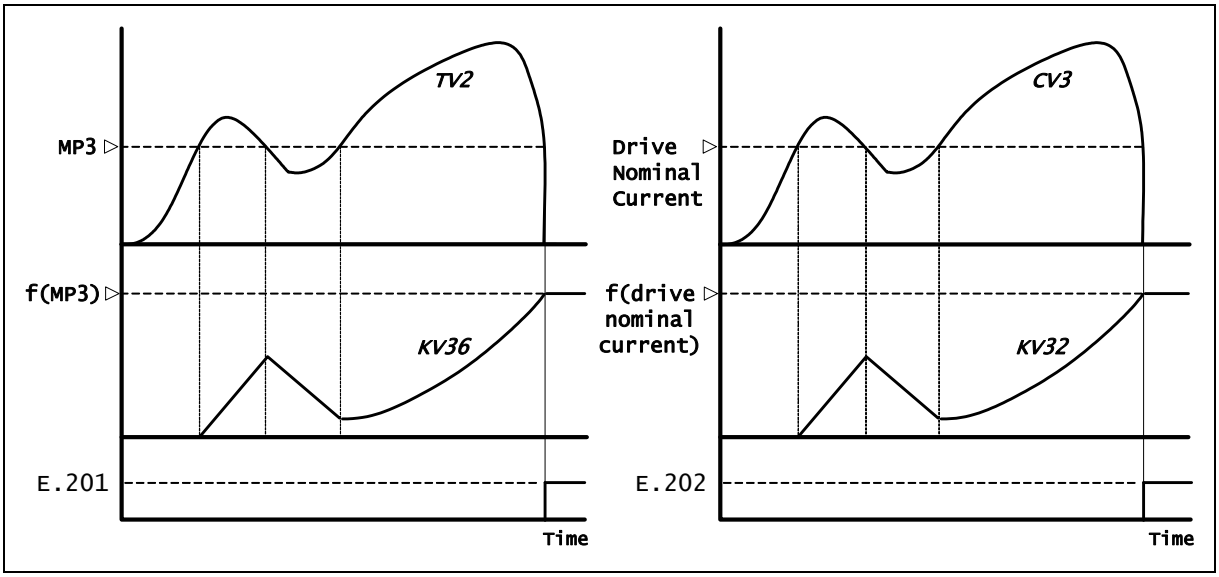
Bad cabling of the position sensor or of the motor power.

The velocity loop is adjusted wrong.

Decrease the speed overshoot in the system response.

E.201 Motor overload

E.202 Drive overload



The I²t 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, one of the codes of the following table will be displayed.

The drive where the alarm has been detected is:

1L	The 1st one of the bottom
1H	The 1st one of the top
2L	The 2nd one of the bottom
2H	The 2nd one of the top

3L	The 3rd one of the bottom
3H	The 3rd one of the top
CR	That of the Ballast

E.304 Power bus voltage of the drive too high

The hardware of the drive module detects 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 check 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 circuit 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.403	Synchronism message missing	

The synchronism message is received erroneously during two consecutive cycles or is no longer received. If the error comes up only once, it adds 1 unit to the value of the QV30 variable (distortion on the line).

E.412	Synchronism message oscillation	

The synchronism message must be received within a ±10 µs margin of the cycle time indicated in parameter QP1, when starting up the unit.

This time margin is usually 4 ms. Therefore, if this is received out of this margin twice in a row, the drive warns about this error. If it only occurs one, it adds 1 unit to the value of the QV30 variable.

E.413	Wrong handshake	

The handshake bit, included in the master's control word and in the drive's status word, does not follow the indicated sequence.

E.502	Incompatible parameters	

Parameter incompatibility.

Example

Let us assume a drive that controls a 4000 rpm motor with its parameters set (e.g.: speed limit SP10 = 4400). If now, a 2000 rpm 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. The error will disappear when the parameters (readjusted in RAM memory by the drive) are saved into E²PROM memory using the GC1 command.

E.506	Motor table missing	

Contact Fagor Automation.

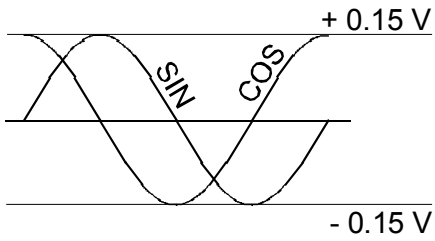
E.510	Incoherent combination of motor and feedback	E.510

Motor not accepted by the drive.

Motor's power voltage is different from that of the drive (e.g.: motor FXM34.40**A**.E1.000 with MCP-20**L** drive).

E.605	Excessive damping of the analog signals of the motor feedback.	E.605

Some of the sine or cosine signals of the encoder has reached a peak level lower than 150 mV.



Contact Fagor Automation.

E.801	Encoder not detected	E.801

The drive has not detected the rotor sensor.

Match the selected sensor with the feedback installed.

Contact Fagor Automation.

E.802	Defective encoder	E.802

Communication error when using a SinCos or SinCoder encoder.

Incoherent U, V, W signals when using an incremental I0 encoder.

Contact Fagor Automation.

E.803	Encoder not initialized	E.803

Contact Fagor Automation.

PARAMETERS, VARIABLES & COMMANDS. IDs

Mnem.	Name	Level	IDSER	Ac	Min.	Max.	Def.	Units	Pag.
BV14	NotProgrammableIOs	Fagor	32972	RO	0	65535	-	-	51
CP1	CurrentProportionalGain	Fagor	00106	RW	0	999	-	-	51
CP2	CurrentIntegralTime	Fagor	00107	RW	0	999	-	-	51
CP20	CurrentLimit	Basic	33075	RW	0.00	50.00	0.00	A	51
CP30	CurrentCommandFilter1Type	Fagor	33076	RW	0	1	0	-	52
CP31	CurrentCommandFilter1Frequency	Fagor	33080	RW	0	4000	0	Hz	52
CP32	CurrentCommandFilter1Damping	Fagor	33081	RW	0	1000	0	Hz	52
CV1	Current1Feedback	User	33077	RO	-50.00	50.00	-	A	52
CV2	Current2Feedback	User	33078	RO	-50.00	50.00	-	A	52
CV3	CurrentFeedback	User	33079	RO	-50.00	50.00	-	A	53
CV10	Current1Offset	Fagor	33073	RO	-2.000	2.000	-	A	53
CV11	Current2Offset	Fagor	33074	RO	-2.000	2.000	-	A	53
DC1	ResetClass1Diagnostics	User	00099	RW	0	15	0	-	54
DC2	ClearHistoricOfErrorsCommand	User	33170	RW	0	15	0	-	54
DV17	HistoricOfErrors	User	33178	RO	-	-	-	-	53
DV31	DriverStatusWord	Fagor	00135	RO	0	65535	-	-	53
DV32	MasterControlWord	Fagor	00134	RW	0	65535	0	-	54
GC1	BackupWorkingMemoryCommand	Basic	00264	RW	0	15	0	-	56
GC3	SincoderAutoTunningCommand	Fagor	33498	RW	0	15	0	-	56
GC10	LoadDefaultsCommand	Basic	00262	RW	0	15	0	-	57
GP3	StoppingTimeout	Basic	33470	RW	0	9999	500	ms	55
GP5	ParameterVersion	Basic	33472	RO	-	-	-	-	55
GP9	DriveOffDelayTime	Basic	00207	RW	0	9999	50	ms	55
GP15	AutomaticInitialization	Fagor	33493	RW	0	1	1	-	55
GP16	MonoPhaseSelector	Basic	33495	RW	0	1	0	-	55
GV2	ManufacturerVersion	Basic	00030	RO	-	-	-	-	56
GV5	CodeChecksum	Basic	33474	RO	-	-	-	-	56
GV7	Password	Basic	00267	RW	0	9999	0	-	56
GV9	DriveType	Basic	00140	RO	-	-	-	-	56
GV11	SoftReset	Basic	33476	RW	0	16	0	-	56
GV16	MotorTableVersion	Basic	33484	RO	-	-	-	-	56
GV75	ErrorList	Fagor	00375	RO	-	-	-	-	56
HV5	PLDVersion	Basic	33063	RO	-	-	-	-	57
IP6	DigitalInputPolarity	User	33678	RW	0	1	0	-	57
IV10	DigitalInputs	User	33675	RO	0	1	-	-	57
KP3	ExtBallastPower	User	33882	RW	200	2000	200	W	58
KP4	ExtBallastEnergyPulse	User	33884	RW	200	2000	200	J	58
KV6	MotorTemperature	Basic	00383	RO	0	200	-	° C	58
KV10	CoolingTemperature	User	33870	RO	0	200	-	° C	58
KV32	I2tDrive	User	33877	RO	0	100	-	%	58
KV36	I2tMotor	User	33879	RO	0	100	-	%	58
KV40	I2tCrowbar	User	33883	RO	0	100	-	%	58
KV41	BallastSelect	User	33885	RW	0	1	1	-	58
MP1	MotorType	Basic	00141	RW	-	-	-	-	59
MP2	MotorTorqueConstant	Fagor	33968	RW	0.00	10.00	10.00	Nm/A	59
MP3	MotorContinuousStallCurrent	Fagor	00111	RW	0.00	50.00	10.00	A	59
MP24	MotorMomentumOfInertia	Fagor	33988	RW	0.1	1000.0	-	kg·cm²	59
NP1	LoadMomentumOfInertiaPercentage	User	34968	RW	0.00	1000.00	0.00	%	60
NP116	ResolutionOfFeedback1	Fagor	00116	RO	0	65535	-	pulses	60
NP121	InputRevolutions	Fagor	00121	RW	1	65535	1	rev	60
NP122	OutputRevolutions	Fagor	00122	RW	1	65535	1	rev	60

Mnem.	Name	Level	IDSER	Ac	Min.	Max.	Def.	Units	Pag.
NP123	FeedConstant	Fagor	00123	RW	0	2^{31}-1	50000	mm	60
OP6	DigitalOutputPolarity	User	34184	RW	0	1	0	-	61
OV10	DigitalOutputs	User	34178	RO	0	1	0	-	61
PC146	NCControlledHoming	Fagor	00146	RW	0	15	0	-	61
PP217	AccelerationFeedforwardPercentage	Fagor	00348	RW	0.0	120.0	0.0	%	61
PV51	PositionFeedback1	Fagor	00051	RO	-2^{31}	2^{31}-1	-	pulses	61
PV173	MarkerPositionA	Fagor	00173	RO	-2^{31}	2^{31}-1	-	-	61
QP1	ControlUnitCycleTime	Fagor	00001	RW	0	10000	4000	-	62
QP11	CanBusSpeed	Fagor	34768	RW	0	20	0	-	62
QP17	CanOpenBorder	Basic	34788	RW	-	-	-	-	62
QV22	IDNListOfInvalidOperationData	Fagor	00022	RO	-	-	-	-	63
QV30	FiberDistErrCounter	Fagor	33495	RO	0	65535	0	-	63
QV96	SlaveArrangement	Basic	00096	RO	1	127	-	-	63
QV190	CanBusSyncJitter	Fagor	34779	RO	- 1000	1000	0	Tick (25 ns)	63
RC1	EncoderParameterStoreCommand	Fagor	34281	RW	0	15	0	-	64
RP1	FeedbackSineGain	Fagor	34268	RW	0	8192	4096	-	63
RP2	FeedbackCosineGain	Fagor	34269	RW	0	8192	4096	-	63
RP3	FeedbackSineOffset	Fagor	34270	RW	- 2000	2000	0	-	64
RP4	FeedbackCosineOffset	Fagor	34271	RW	- 2000	2000	0	-	64
RP20	StegmanABLevelSense	User	34305	RW	30	100	100	%	64
RP77	PositionFeedback1Type	Fagor	00277	RW	- 32768	32767	0	-	64
RV1	FeedbackSine	User	34274	RO	- 512	511	-	-	64
RV2	FeedbackCosine	User	34275	RO	- 512	511	-	-	64
RV3	FeedbackRhoCorrection	Fagor	34276	RO	0	65535	-	-	64
SP1	VelocityProportionalGain	Basic	00100	RW	0.0	999.9	-	mA/rpm	64
SP2	VelocityIntegralTime	Basic	00101	RW	0.1	999.9	-	ms	64
SP10	VelocityLimit	Basic	00091	RW	0	9999	1000	rpm	65
SP42	StandStillWindow	User	00124	RW	0	9999	20	rpm	65
SP43	VelocityPolarityParameters	Basic	00043	RW	0	1	0	-	65
SP50	VelocityFeedbackFilterFrequency	Basic	34782	RW	0	4000	800	Hz	66
SP60	AccelerationLimit	Basic	00138	RW	0.0	400.0	0.0	rpm/ms	66
SP65	EmergencyAcceleration	Basic	34377	RW	0.0	400.0	0.0	rpm/ms	66
SP66	VelocityDecelerationTime	Basic	34386	RW	0.0	400.0	0.0	rpm/ms	67
SV1	VelocityCommand	Basic	00036	RW	- 6000.0000	6000.0000	-	rpm	67
SV2	VelocityFeedback	Basic	00040	RO	- 6000.0000	6000.0000	-	rpm	67
SV6	VelocityCommandAfterFilters	Basic	34390	RO	- 6000.0000	6000.0000	-	rpm	67
SV7	VelocityCommandFinal	Basic	34380	RO	- 6000.0000	6000.0000	-	rpm	67
TP10	ConstantPositiveTorqueCompensation	User	34670	RW	0.0	100.0	0.0	Nm	68
TP11	ConstantNegativeTorqueCompensation	User	34671	RW	0.0	100.0	0.0	Nm	68
TP12	DynamicPositiveTorqueCompensation	User	34672	RW	0.0	100.0	0.0	Nm	68
TP13	DynamicNegativeTorqueCompensation	User	34673	RW	0.0	100.0	0.0	Nm	68
TP14	TorqueCompensationTimeConstant	User	34676	RW	0.0	2000.0	0.0	ms	69
TP15	TorqueCompensationSpeedHysteresis	User	34677	RW	0.2000	1000.0000	0.0000	rpm	70
TV1	TorqueCommand	User	00080	RO	- 99.9	99.9	-	Nm	70
TV2	TorqueFeedback	User	00084	RO	- 99.9	99.9	-	Nm	70
TV4	SpeedIntegralAction	User	34680	RO	- 1000.0	1000.0	-	Nm	70

User notes.

User notes.

FAGOR subsidiaries:

SPAIN

Headquarters:
FAGOR AUTOMATION S. COOP.

Bº San Andrés 19, Apdo. 144
E-20500 ARRASATE-MONDRAGON
www.fagorautomation.com
E-mail: info@fagorautomation.es
Tel: 34-943-719200 / 34-943-039800
Fax: 34-943-791712
34-943-771118 (Service Dept.)

Usurbil:
FAGOR AUTOMATION S.COOP.
Planta de Usurbil
San Esteban s/n Txoko-Alde
E-20170 USURBIL
Tel: 34-943-000690
Fax: 34-943-360527
E-mail: usurbil@fagorautomation.es

Eskoriatza:
FAGOR AUTOMATION S.COOP.
Planta de Eskoriatza
Torrebaso Pasealekua, 4, Apdo. 50
E-20540 ESKORIATZA
Tel: 34-943-719200
Fax: 34-943-039783

Barcelona:
FAGOR AUTOMATION, Catalunya
Parc Tecnològic del Vallès,
Tecnoparc II
Edificio I Módulo Ab
C/Argenters, 5
08290 Cerdanyola del Vallès
Tel.: 34-93-4744375
Fax: 34-93-4744327
E-mail:
del.catalunya@barna.fagorautomation.es

FRANCE

FAGOR AUTOMATION FRANCE Sàrl
Parc Technologique de La Pardieu
16 Rue Patrick Depailler
63000 CLERMONT FERRAND
Tel.: 33-473277916
Fax: 33-473150289
fagorautomation@wanadoo.fr

GERMANY

FAGOR AUTOMATION GmbH
Postfach 604 D-73006 GÖPPINGEN
Nördliche Ringstrasse, 100
Tel.: 49-7161 15685-0
Fax: 49-7161 1568579
E-mail: automation@fagor.de

ITALY

FAGOR ITALIA S.R.L.
Pal. CD3 P.T. - Via Roma, 108
20060 CASSINA DE PECCHI (MI)
Tel.: 39-0295301290
Fax: 39-0295301298
E-mail: italy@fagorautomation.it

UNITED KINGDOM

FAGOR AUTOMATION UK Ltd.
2 A Brunel Close
Drayton Field Industrial Estate
Daventry Northamptonshire
NN11 8RB
Tel: 44-1327 300067
Fax: 44-1327 300880
E-mail: info@fagorautomation.co.uk

PORTUGAL

FAGOR AUTOMATION LTDA.
Sucursal Portuguesa
Rua Gonçalves Zarco nº 1129-B-2º
Salas 210/212
4450 LEÇA DA PALMEIRA
Tel: 351 22 996 88 65
Fax: 351 22 996 07 19
E-mail: fagorautomation@fagorautomation.pt

USA

Chicago:
FAGOR AUTOMATION CORP.
2250 Estes Avenue
ELK GROVE VILLAGE, IL 60007
Tel: 1-847-9811500
1-847-9811595 (Service)
Fax:1-847-9811311
E-mail: fagorusa@fagor-automation.com

California:
FAGOR AUTOMATION West Coast
3176 Pullman Ave., Unit 110
COSTA MESA, CA 92626
Tel: 1-714-9579885
Fax: 1-714-9579891
E-mail: caservice@fagor-automation.com

New Jersey:
FAGOR AUTOMATION East Coast
Tel: 1-973-7733525
Fax: 1-973-7733526
E-mail: wnelson@fagor-automation.com

South East:
FAGOR AUTOMATION SOUTH EAST
4234 Amber Ridge Ln- VALRICO, FL 33594
Tel: 813 654 4599
E-mail: jkas@fagor-automation.com

Ohio:
FAGOR AUTOMATION OHIO BRANCH
Westerville OH 43081
Tel: 1 614-855-5720
Fax: 1 614-855-5928
E-mail: tdrane@fagor-automation.com

CANADA

Ontario:
FAGOR AUTOMATION ONTARIO
Unit 3, 6380 Tomken Road
MISSISSAUGA L5T 1Y4
Tel: 1-905-6707448
Fax: 1-905-6707449
E-mail: sales@fagorautomation.on.ca

Montreal:
FAGOR AUTOMATION QUEBEC
Tel.: 1-450-2270588
Fax: 1-450-2276132
E-mail: montreal@fagorautomation.on.ca

Windsor:
FAGOR AUTOMATION WINDSOR
Tel.: 1-519 944-5674
Fax: 1-519 944-2369

BRAZIL

FAGOR AUTOMATION DO BRASIL
COM.IMP. E EXPORTAÇAO LTDA.
Rua Homero Baz do Amaral, 331
CEP 04774-030 SAO PAULO-SP
Tel.: 55-11-56940822
Fax: 55-11-56816271
E-mail: brazil@fagorautomation.com.br

CHINA

Beijing:
BEIJIN FAGOR AUTOMATION EQUIPMENT
Co.,LTD.
C-1 Yandong Building,
No.2 Wanhong Xijie, Xibajianfang
Chaoyang District
BEIJING, Zip Code: 100015
Tel: 86-10-84505858
Fax: 86-10-84505860
E-mail: info@fagorautomation.com.cn

Nanjing:
FAGOR AUTOMATION EQUIPMENT LTD.
NANJING OFFICE
Room 803, Holiday Inn (Nanjing)
45 Zhongshan Beilu,
210008 NANJING, P.R. CHINA
Tel: 86-25-83328259
Fax: 86-25-83328260
E-mail: fagor_nj@fagorautomation.com.cn

Guangzhou:
Beijin FAGOR AUTOMATION Equipment Ltd.
Guangzhou Office
Room 915 Lihao Plaza
No. 18 Jichanglu Baiyun District
510405 GUANGZHOU, P.R CHINA.
Tel: 86-20-86553124
Fax: 86-20-86553125
E-mail: fagor_gz@fagorautomation.com.cn

Shanghai:
Beijing FAGOR AUTOMATION equipment
Ltd. SHANGHAI BRANCH
Room No.547 Tianmu Xilu
20070 SHANGHAI, P.R CHINA.
Tel: 86-21-63539007/63538919
Fax: 86-21-63538840
E-mail: fagor_sh@fagorautomation.com.cn

Chengdu:
Beijing FAGOR AUTOMATION equipment
Ltd. Chengdu Office
Room 912, No. 16 Dayelu
610100 CHENGDU, P.R CHINA.
Tel: 86-28-66132081
Fax: 86-28-66132082
E-mail: fagor_cd@fagorautomation.com.cn

HONG KONG

FAGOR AUTOMATION (ASIA) LTD.
Room 628. Tower II, Grand Central Plaza
138 Shatin Rural Committee Road
Shatin, HONG KONG
Tel: 852-23891663
Fax: 852-23895086
E-mail: fagorhk@fagorautomation.com.hk

KOREA, Republic of

FAGOR AUTOMATION KOREA, LTD.
Room No. 707 Byucksan Digital Valley 2nd
481-10 Gasan-dong. Geumcheon-gu
Seoul 153-803, Korea
Tel: 82 2 2113 0341
Fax: 82 2 2113 0343
E-mail: korea@fagorautomation.com.kr

TAIWAN, R.C.O.

FAGOR AUTOMATION TAIWAN CO., LTD.
Nº 24 Ta-Kuang St. Nan-Tun Dist. 408
Taichung, TAIWAN R.O.C.
Tel: 886-4-2 3271282
Fax: 886-4-2 3271283

SINGAPORE

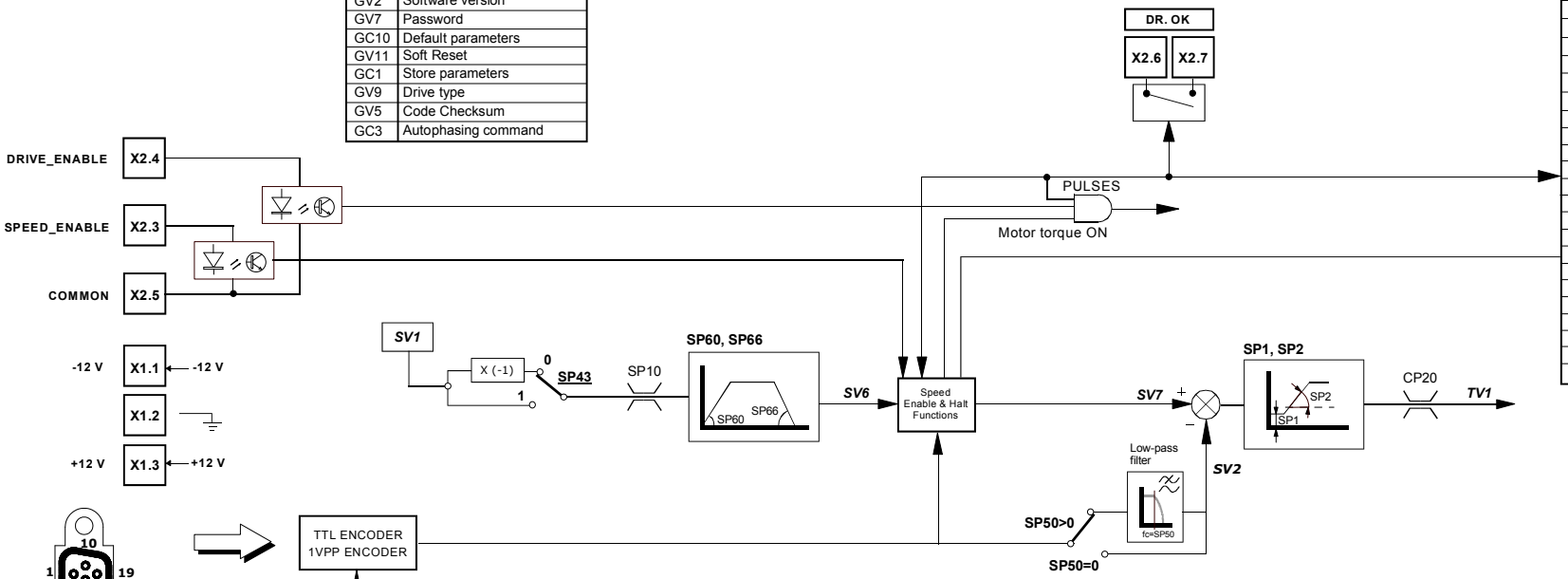
FAGOR AUTOMATION (S) PTE.LTD.
240 MacPherson Road
06-05 Pines Industrial Building
SINGAPORE 348574
Tel: 65-68417345 / 68417346
Fax: 65-86417348
E-mail: singapore@fagorautomation.com.sg

MALAYSIA

FAGOR AUTOMATION (M) SDN.BHD.
(638038-H)
No.39, Jalan Utama 1/7
Taman Perindustrian Puchong Utama
47100 Puchong, Selangor Darul Ehsan
Tel: +60 3 8062 2858
Fax: +60 3 8062 3858
E-mail: malaysia@fagorautomation.com.sg

VELOCITY CONTROL BLOCK DIAGRAM

GENERAL PARAMETERS	
GV2	Software version
GV7	Password
GC10	Default parameters
GV11	Soft Reset
GC1	Store parameters
GV9	Drive type
GV5	Code Checksum
GC3	Autophasing command



ERROR	DESCRIPTION
E.001	Watch dog
E.003	Power supply fault
E.004	Stop time > GP3
E.106	Drive overtemp
E.108	Motor overtemp
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.403	Synchronism message missing
E.412	Synchronism message oscillation
E.413	Wrong handshake
E.502	Incompatible parameters
E.506	Motor table missing
E.510	Incoherent combination of motor and feedback
E.605	Feedback signals excessively damped
E.801	Encoder not detected
E.802	Defective encoder
E.803	Encoder not initialized

MP1 WITH FEEDBACK TYPE

I0	INCREMENTAL ENCODER: (2500 ppt)
E1	SinCoder ENCODER (1024 ppt)
E3	SinCos ENCODER (1024 ppt)
A1	MULTI-TURN SinCoder ENCODER (1024 ppt)
A3	MULTI-TURN SinCos ENCODER (1024 ppt)

MOTOR PARAMETERS	
MP1	Motor type
MP2	Torque constant
MP3	Rated current
MP24	Inertia

FXM □□.□□□.□□.□□□-X□□

FAGOR SYNCHRONOUS MOTOR		
SIZE	**1, 3, 5, 7**	
LENGTH	**1, 2, 3, 4, 5**	
RATED SPEED	**12** 1200 rev/min	**30** 3000 rev/min
	20 2000 rev/min	**40** 4000 rev/min
WINDING	**F** 220 V AC	
	A 400 V AC	
FEEDBACK TYPE	**I0** Incremental encoder (2500 ppt)	
	A1 Absolute multi-turn SinCos encoder (1024 ppt)	
	E1 SinCoder encoder (1024 ppt)	
FLANGE & SHAFT	**0** IEC Standard	
	1 Keyless shaft	
	8 NEMA Standard (USA)	
	9 Special	
BRAKE OPTION	**0** Without brake	
	1 With standard brake (24 V DC)	
VENTILATION	**0** Without fan	
	1 With standard fan	
	9 With special fan	
SPECIAL CONFIGURATION	**X**	
SPECIFICATION	**01 → ZZ**	
	Only when it has a special configuration (X) !	

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

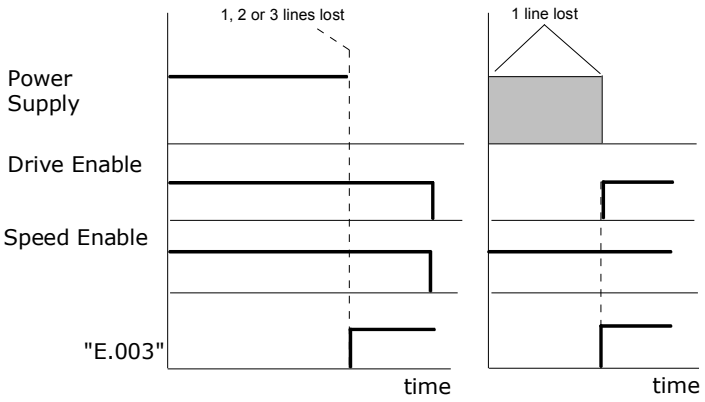
FKM □□.□□□.□□.□□□.□-K□□

FAGOR SYNCHRONOUS MOTOR		
SIZE	**2, 4, 6**	
LENGTH	**1, 2, 3, 4**	
RATED SPEED	**20** 2000 rev/min	**45** 4500 rev/min
	30 3000 rev/min	**50** 5000 rev/min
	40 4000 rev/min	**60** 6000 rev/min
WINDING	**A** 400 V AC	
	F 220 V AC	
FEEDBACK TYPE	**I0** Incremental encoder (2500 ppt)	
	A3 Absolute multi-turn SinCos encoder (1024 ppt)	
	E3 SinCos encoder (1024 ppt)	
FLANGE & SHAFT	**0** With keyway (equilibrado a 1/2 chaveta)	
	1 Cylindrical (with no keyway)	
	2 Shaft with key and seal	
	3 Keyless shaft with seal	
BRAKE OPTION	**0** Whitout brake	
	1 With standard brake (24 V DC)	
CONNECTION	**0** Rotating angled connectors	
	1 Cable output without connectors	
	9 Special	
	2 Optimized for ACSD-16H	
SPECIAL CONFIGURATION	**K**	
SPECIFICATION	**01 → ZZ**	
	Only when it has a special configuration (K) !	

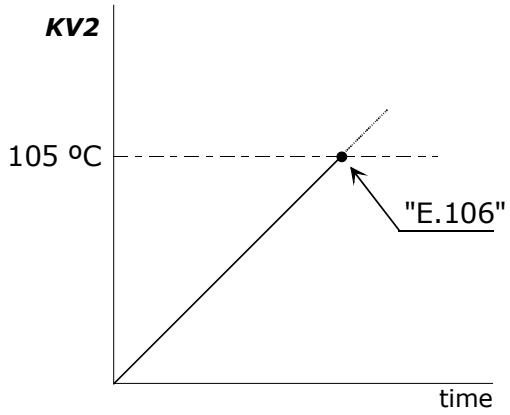
Note. Motor with F type winding may carry an encoder with incremental I0. The rest of feedback devices with only be available on motors with A type winding.

ERROR FUNCTIONS

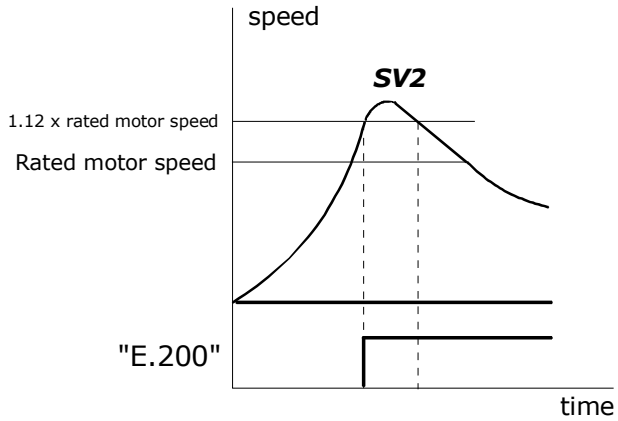
Function "E.003" | Power Supply fault



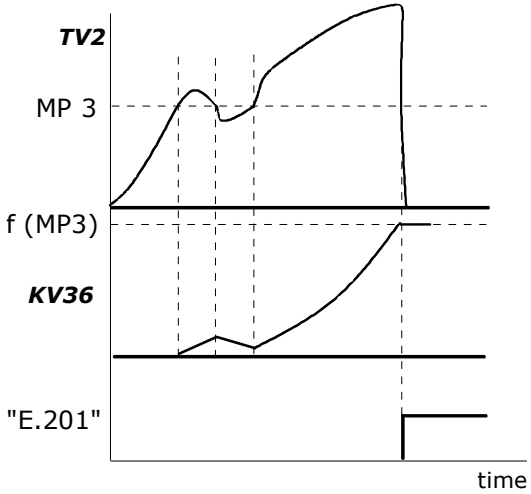
Function "E.106" | Drive Overtemp



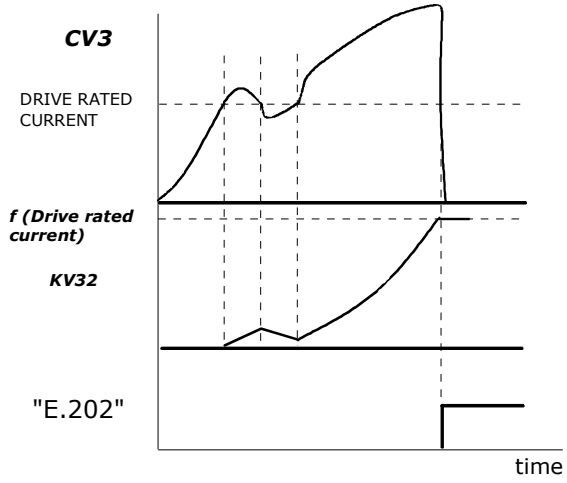
Function "E.200" | Overspeed



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