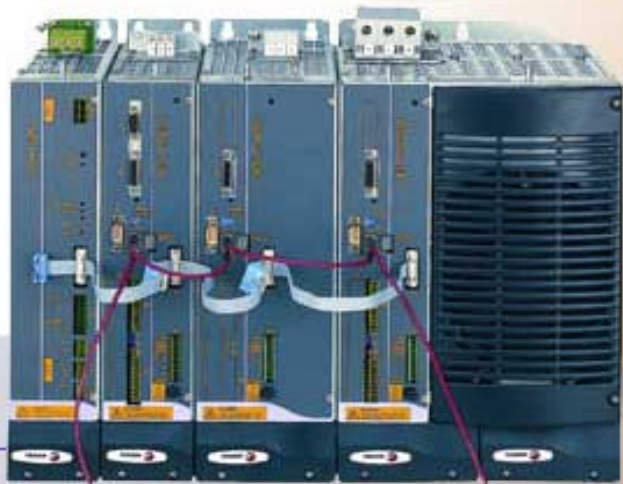


# Digital Servo Drive System



Ref. 0607

## ORDERING HANDBOOK

## Modular system

### > Modular drives system

It is configured with power supply modules that are connected directly to mains and with specific drive modules to govern axis and spindle motors.

**Non regenerative power supplies (PS)**

**Regenerative power supplies (XPS, RPS)**

**Axis drives (AXD)**

**Spindle drives (SPD)**

**Other modules**

## Range of Fagor Power Supplies

### > Models

NON REGENERATIVE			
Model	Output power	Input voltage	Output 24 V DC for drive control signals
PS-25B4	25 kW	400 - 460 V AC	24 V DC / 192 W
PS-65A	65 kW	400 - 460 V AC	24 V DC / 240 W

REGENERATIVE			
Model	Output power	Input voltage	Output 24 V DC for drive control signals
XPS-25	25 kW	400 - 460 V AC	24 V DC / 192 W
XPS-65	65 kW	400 - 460 V AC	24 V DC / 192 W

Model	S1 / S6-40% output power	Input voltage	Output 24 V DC for drive control signals
RPS-75	75/97 kW	400 - 460 V AC	24 V DC / 192 W
RPS-45	45/59 kW	400 - 460 V AC	24 V DC / 192 W
RPS-20	20/26 kW	400 - 460 V AC	24 V DC / 192 W

## > Connection to mains

### Input Voltage

The Fagor DDS servo drive system requires a mains voltage between 400 V AC - 10% and 460 V AC + 10%

### Fuses

Module receiving mains power	Recommended Siemens fuse
Reference	Reference
PS-25B4 XPS-25 RPS-20	3NE8 003
PS-65A XPS-65 RPS-45	3NE8 021
RPS-75	3NC8423-3

Fuses MUST be included to protect the Fagor Servo Drive System

### Transformer / Auto-transformer

It should be used when the mains voltage must be isolated or adapted to the levels required by the DDS system in order to ensure maximum motor power.

A power transformer or auto-transformer must be used

$$[ \mathbf{1} + \mathbf{2} ] * 1,05 \text{ kVA} = \mathbf{4} \text{ kVA}$$

<b>1</b>	---	Sum of axes powers (kW)	---	See in page 11
<b>2</b>	---	Sum of spindle powers (kW)	---	See in page 12

**Very important:** When using an isolating transformer, the secondary must have a star connection and its mid point must be accessible so it can be connected to ground. This means that the output voltage of the transformer/autotransformer is maintained for the indicated apparent power. **Note that** if the system has an **XPS power supply**, the rated power Pm of cell (2) of the previous expression corresponds to the sum of the Pn's of all the asynchronous spindle motors of the system, whose value is the result of applying the expression **Pn = 1.4 · Pmax** for each of them and then adding them all. **Pmax will be the motor's maximum braking power and it may be, in general, close to the power of the asynchronous spindle motor in S6.** If it is a **PS power supply**, cell (2) will register the value obtained from the table in page 3 of the FM7 Ordering Handbook.

**Mains filter against electromagnetic interference.**

Module receiving mains power	Mains filter EMC	Rated current	Weight
Reference	Reference	A	kg
XPS-25, RPS-20 PS-25B4 ACD / SCD / CMC 1.08 / 1.15 / 1.25A ACD / SCD / CMC 2.35	MAIN FILTER 42A	42	2.8
PS-65A , XPS-65,RPS-45, RPS-75	MAIN FILTER 130A	130	7.5

In order for Fagor Servo drive system to meet the European Directives on Electromagnetic Compatibility (EMC) this mains filter must be included in the servo system.

**Choke inductance**

Choke inductance for filtering the current returned to mains by the XPS Power Supplies. These chokes are a must for the proper operation of the Regenerative Power Supplies XPS.

Recoverig Power Supply	Choke inductance	Cable section
XPS-25	CHOKE XPS-25	10mm <sup>2</sup>
XPS-65	CHOKE XPS-65	50mm <sup>2</sup>
RPS-20	CHOKE RPS-20	10mm <sup>2</sup>
RPS-45	CHOKE RPS-45	35mm <sup>2</sup>
RPS-75	CHOKE RPS-75	70mm <sup>2</sup>

**> Cables**

**POWER CABLE FOR MAINS CONNECTION**

Vmains from 400 - 460 V AC

Rated current through the mains cable

MAINS POWER \_\_\_\_\_  $\neq$

**4** ( kW \* 1000 / (sqrt3 \* Vmains) ) =  A  $\neq$  **C**

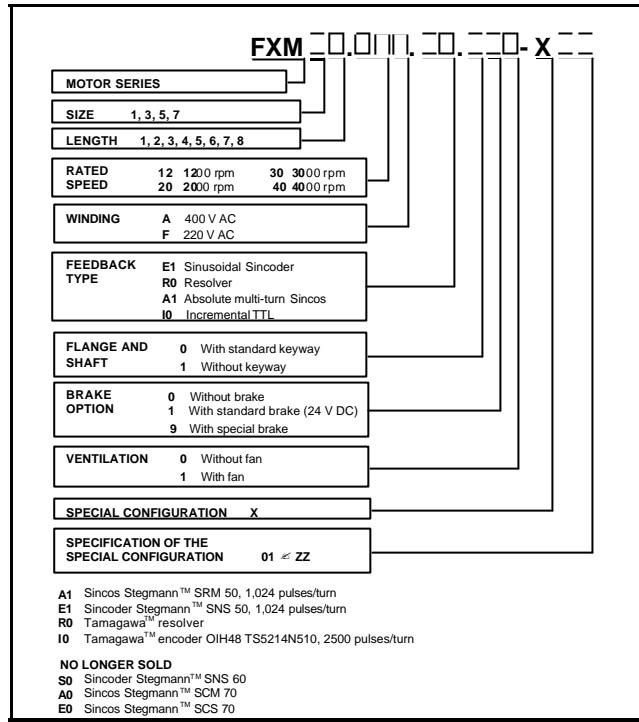
Power cable	
In Amperes	Reference
if C < 12.5	MPC - 4 x 1.5
if C < 16.5	MPC - 4 x 2.5
if C < 23	MPC - 4 x 4
if C < 29	MPC - 4 x 6
if C < 40	MPC - 4 x 10

The purchase order must indicate the length of the cables.

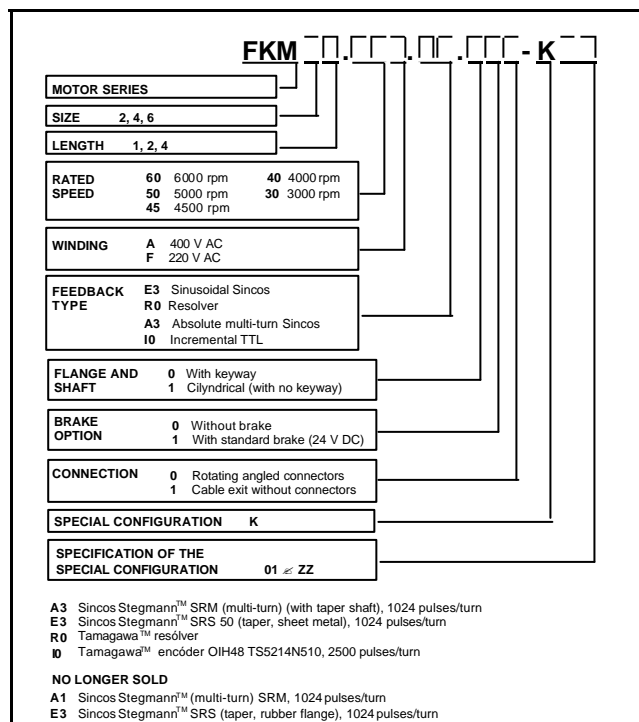
# Axis and Spindle drives

## > References of synchronous servo motors

### FXM



### FKM



**> Technical data****Currents on modular axis drives for synchronous motors.  $f_c = 4$  kHz.**

With internal fan	Drive for synchronous motor (as axis)									
Currents at $f_c = 4$ kHz (Arms)	AXD 1.08	AXD 1.15	AXD 1.25	AXD 1.35	AXD 2.50	AXD 2.75		AXD 3.100	AXD 3.150	
I S1 ( $= I_N$ ) (Arms)	4	7.5	12.5	17.5	23.5	31.5		50	62	
Imax (Arms) (S3-5)	8	15	25	35	47	63		100	124	
Dissipated power (W)	33	69	115	156	225	285		513	617	

**Currents on modular axis drives for synchronous motors.  $f_c = 8$  kHz.**

With internal fan	Drive for synchronous motor (as axis)									
Currents at $f_c = 8$ kHz (Arms)	AXD 1.08	AXD 1.15	AXD 1.25	AXD 1.35	AXD 2.50	AXD 2.75		AXD 3.100	AXD 3.150	
I S1 ( $= I_N$ ) (Arms)	4	7.5	12.5	17.5	23.5	31.5		50	62	
Imax (Arms) (S3-5)	8	15	25	35	47	63		100	124	
Dissipated power (W)	44	89	148	195	305	395		695	847	

**Current in modular spindle drives for synchronous or asynchronous motors.  $f_c = 4$  kHz.**

With internal fan	Drive for synchronous or asynchronous motor (as spindle)									
Currents at $f_c = 4$ kHz (Arms)			SPD 1.25	SPD 1.35	SPD 2.50	SPD 2.75	SPD 2.85	SPD 3.100	SPD 3.150	SPD 3.200
I S1 ( $= I_N$ ) (Arms)			16	23.1	31	42	50	70	90	121
0.7 x $I_N$ (Arms)			11.2	16.1	21.7	29	35	49	63	84.7
I S6-40 (Arms)			20.8	30	40.3	54.6	65	91	117	157.3
Imax (Arms) (S6-15)			22	32	45	65	72.5	91	140	170
Dissipated power (W)			146	195	349	390	432	724	904	1.163

**Current in modular spindle drives for synchronous or asynchronous motors.  $f_c = 8$  kHz.**

With internal fan	Drive for synchronous or asynchronous motor (as spindle)									
Currents at $f_c = 8$ kHz (Arms)			SPD 1.25	SPD 1.35	SPD 2.50	SPD 2.75	SPD 2.85	SPD 3.100	SPD 3.150	SPD 3.200
I S1 ( $= I_N$ ) (Arms)			13	18	27	32	37	56	71	97
0.7 x $I_N$ (Arms)			9.1	12.6	18.9	22.4	25.9	39.2	49.7	67.9
I S6-40 (Arms)			16.9	23.4	35.1	41.6	48.1	72.8	92.3	126.1
Imax (Arms) (S6-15)			17.8	24.9	39.1	65.0	53.6	72.8	110.4	136.5
Dissipated power (W)			145	201	350	395	438	743	930	1.187

### Technical characteristics of the modular drives

	AXD // SPD // MMC									
	1.08	1.15	1.25	1.35	2.50	2.75	2.85	3.100	3.150	3.200
Power voltage input	542 - 800 V DC									
Power to control circuits	24 V DC (between 21 V DC and 28 V DC)									
Consumption of the control circuits (24 V DC)	0.9 A			1.25 A			2 A			
Speed feedback	Encoder // Resolver									
Controlling method	PWM, AC sinewave, vector control									
Communication	Serial line to connect to a PC									
Interface	Standard analog or digital via SERCOS® (in all models). Serial line RS232/RS422 (only in MMC drives)									
Status display	7-segments display									
Protections	Over-voltage, over-current, over-speed, heat-sink temperature, ambient temperature, motor temperature, hardware error, overload.									
Speed range with analog input	1 : 8192									
Current bandwidth	800 Hz									
Speed bandwidth	100 Hz (depends on the motor/drive set)									
Operating ambient	5 °C / 45 °C (41 °F/113 °F) From 40 °C (104 °F). See derating curves.									
Storage temperature	-20 °C / +60 °C (-4 °F / 140 °F)									
Sealing	IP2x									
Maximum humidity	< 90 % ( non condensing at 113 °F / 113 °F )									
Operating vibration	0.5 G									
Shipping vibration	2 G									
Approximate weight in kg (lb)	5.5 (12.1)	6.0 (13.2)	6.5 (14.3)	9.0 (19.8)	9.0 (19.8)	10.0 (22.0)	16.5 (36.4)	17.0 (37.5)	19.5 (43.0)	

### > Drives Combination

Refer to the relevant Ordering Handbook to know the drive associated with FXM and FKM motors.

## > Cables

### Ready made fiber cables to close the sercos interface ring.

Length	1m	2m	3m	5m	7m	10m	12m	15m	20m	25m
Reference	SFO-1	SFO-2	SFO-3	SFO-5	SFO-7	SFO-10	SFO-12	SFO-15	SFO-20	SFO-25

Length	10m	15m	20m	25m	30m
Reference	SFO-FLEX-10	SFO-FLEX-15	SFO-FLEX-20	SFO-FLEX-25	SFO-FLEX-30
Length	35m	40m	45m	50m	
Reference	SFO-FLEX-35	SFO-FLEX-40	SFO-FLEX-45	SFO-FLEX-50	

Each drive module having the Sercos interface option comes with a small fiber cable for connecting it to the adjacent module.

Order only the cables connecting the CNC to the drives.

### Ready made connections for the encoder simulator.

Length	1m	3m	5m	10m	15m	20m	25m	30m	35m
Reference	SEC-1	SEC-3	SEC-5	SEC-10	SEC-15	SEC-20	SEC-25	SEC-30	SFO-35

Length	1m	3m	5m	10m	15m
Reference	SEC-HD-1	SEC-HD-3	SEC-HD-5	SEC-HD-10	SEC-HD-15
Length	20m	25m	30m	35m	
Reference	SEC-HD-20	SEC-HD-25	SEC-HD-30	SEC-HD-35	

This connections join the Drive module to the CNC. Reference SEC-XX includes the necessary connectors at both ends.



### Ready made connections for the direct feedback.

Length	1m	3m	6m	9m	12m
Reference	EC-PD 1	EC-PD 3	EC-PD 6	EC-PD 9	EC-PD 12

Length	1m	3m	6m	9m	12m	15m
Reference	EC-1B-D	EC-3B-D	EC-6B-D	EC-9B-D	EC-12B-D	EC-15B-D

This connections join the Drive module to the Direct Sensor. Reference EC-PD XX includes the necessary connectors at both ends.





## Other modules

### > Auxiliar power supply APS 24

The control circuits of the modular Power Supply and Drives require 24 V DC. If the Power Supply doesn't offer that voltage use the Auxiliar Power Supply APS 24



Compact Modules, PS-25Bx or XPS Systems DO NOT require the Auxiliary Power APS 24.

### > Capacitor module for energy storage

Energy Stored in the Power Bus depending on the Vmains.		
Vmains:	400	600
PS-65A	69	63
XPS-25	34	96
XPS-65	61	172

Ws

Effect of the Capacity Module			
	Vmains:	400	600
CM 1.60 +	PS-65A	439	397
	XPS-25	149	421
	XPS-65	176	498

Ws

	Capacity	Weight
CM 1.60	4mF	8.6 kg (18.2 lbf)

The Capacitor module IS NOT applicable to Compact Drives.

### > Ballast resistor

If the energy returned to the Drives (due to motor braking) is so large that it cannot be dissipated by the Ballast resistor of the Power Supply, it is necessary to increase the power of the resistor by means of an external module (external Ballast resistor)

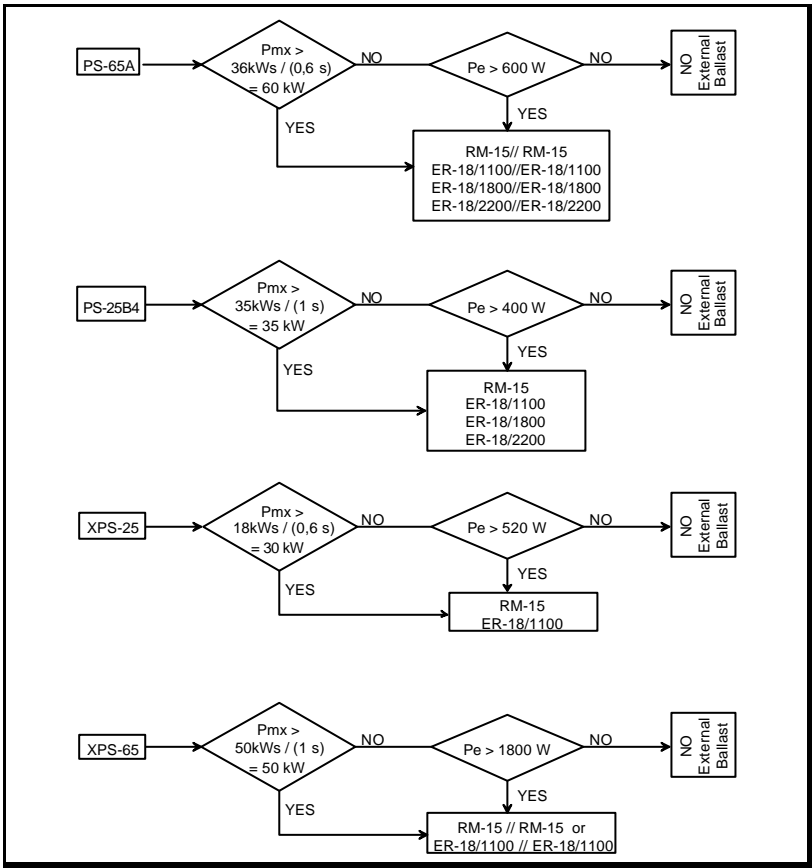
$$W_m = W_p + \frac{1}{2} J_t \left[ \frac{2n}{60} \right]^2 Ws$$

$$W_p = m g h$$

$$P_e = \sqrt{\frac{W_{mi}}{t_i}} W$$

$$P_{mx} = \frac{W_{mi}}{t_i} kW_{max}$$

**W<sub>m</sub>**: Energy generated by the braking of each system motor.  
**Pe**: Rms power generated by all braking of all the motors throughout a complete duty cycle.  
**Jt**: Total inertia of the servo system (motor + mechanics) (in kg·m<sup>2</sup>).  
**n**: Turning speed of the motor when the braking starts (in rpm).  
**W<sub>mi</sub>**: Energy of each braking during a cycle of time T (in W·s).  
**W<sub>p</sub>**: Potential energy lost by the machine mass while braking (only on non-compensated axes) (in W·s).  
**t<sub>i</sub>**: Braking time (in seconds) when the W<sub>mi</sub> energy is generated.  
**T**: Time (in seconds) in a full cycle.  
**h**: Height (in meters) lost while braking .  
**W<sub>mx</sub>**: Maximum energy among all the W<sub>m</sub>.  
**P<sub>mx</sub>**: Maximum power generated by all the braking, given by the maximum value among all the (W<sub>mi</sub> / t<sub>i</sub>) quotients of each braking (in kW).



Check that the external resistor meets the W<sub>mx</sub> and Pe requirements of the application.

	ER-43/350	ER-24/750	ER-18/1100	ER-18/1800	ER-18/2200	ER-33/550	ER-18/900
<b>W<sub>mx</sub></b>	20kJ	40kJ	60kJ	55kJ	83kJ	3kJ	4kJ
<b>Pe</b>	300W	650W	950W	1300W	2000W	250W	450W

## Power Supply for modular drives

### > First criteria

The power supply module must be capable of supplying the power required by the all the motor-drive sets connected to it.

### > Second criteria

The power supply module must be capable of supplying the peak power required (depending on the duty cycles) by the all the motor-drive sets connected to it.

### > Power required for axis motors: FXM and FKM

Follow the calculating to determine which Power Supply module is needed for the set of modular drives.

Power (characteristics table)

n : Maximum axis speed in the application (rpm)  
 nN: Rated motor speed (rpm)  
 $P_a = P_{cal} \cdot 1,17 \cdot [n/nN]$  : Axis power (kW)  
 See FXM or FKM Ordering Handbook

	Axes	Pcal	n	nN	Pa	
		kW	rpm	rpm	kW	
<b>GROUP I</b> From 0 to 2 kW Synchronous	1					
	2					
	3					
	<b>Sum of GROUP I:</b>					
<b>GROUP II</b> From 2 to 8.5 kW Synchronous	1					
	2					+
	3					
	<b>Sum of GROUP II:</b>					
<b>GROUP III</b> From 8.5 to 27 kW Synchronous	1					
	2					+
	3					
	<b>Sum of GROUP III:</b>					
=						
<b>SUM OF POWER: ( kW )</b>						<b>1</b>

Synchronous motors per group	K factor
1	1
2	0.63
3	0.50
4	0.38
5	0.33
6	0.28

...where:

**Pcal**: motor power (kW) according to the motor characteristics  
**1,17**: coefficient that stores the efficiency of the motor (0.9) and that of the drive (0.95).

The servo set is divided in groups depending on their power by applying to each one a simultaneity factor Ki, Kii, Kiii.

> Peak Power required for axis motors: FXM and FKM

Power P (S3-5% cycle)				
		P (S3-5%) (kW)		
<b>GROUP I</b> From 0 to 2 kW Synchronous	1		Sum of GROUP I:	
	2			+
	3			
<b>GROUP II</b> From 2 to 8.5 kW Synchronous	1		Sum of GROUP II:	
	2			+
	3			
<b>GROUP III</b> From 8.5 to 27 kW Synchronous	1		Sum of GROUP III:	
	2			+
	3			
				=
<b>SUM OF POWER: (kW)</b>				<b>3</b>

Synchronous motors per group	k factor	Drive	P (S3-5%)
1	1	AXD 1.08	6
2	0.63	AXD 1.15	12
3	0.50	AXD 1.25	19
4	0.38	AXD 1.35	27
5	0.33	AXD 2.50	36
6	0.28	AXD 2.75	48
		AXD 3.100	77
		AXD 3.150	95

kW.

> Power required for Spindle motors: FM7

Maximum power consumed by the power supply (kW) See FM7 Ordering Handbook	
ASYNCHRONOUS	Asynchronous for spindle
	1
	2
<b>SUM OF POWER: (kW)</b>	
<b>2</b>	

**Pm:** Required power obtained for the asynchronous spindle drive in S6-40% cycles. This data includes the internal losses of the drive.

## > First Criteria

The power supply module must be capable of supplying the power required by the all the motor-drive sets connected to it.

REQUIRED POWER:  $1 + 2 = A$  kW

Rated power (in duty cycle S1)	Power supply module
In kW	Reference
If $A < 20$	RPS-20
If $20 < A < 25$	PS-25B4, XPS-25
If $25 < A < 45$	RPS-45
If $45 < A < 65$	PS-65A, XPS-65
If $65 < A < 75$	RPS-75
If $A > 75$	⚡

⚡ Until reaching the rated power demanded from the power supply. All the required power cannot be supplied, thus 2 power supplies will be needed.

**Very important:** When using two power supplies on the same machine, they must make up two independent groups with their own drives. Only the SERCOS® ring (if there is one) may be common to both groups.

**Note that:** If the power required by the set is greater than 75 kW, the set of motors and drives must be divided into groups and powered by different power supplies.

## > Second Criteria

The power supply module must be capable of supplying the peak power required (depending on the duty cycles) by the all the motor-drive sets connected to it.

REQUIRED PEAK POWER:  $3 + 2 = B$  kW

	Peak power (depending on the duty cycle)	Power supply module
	In kW	Reference
<b>NON-REGENERATIVE POWER SUPPLIES</b>	If $B < 75$	PS-25B4
	If $75 < B < 195$	PS-65A
	If $B > 195$	⚡
<b>REGENERATIVE POWER SUPPLIES</b>	If $B < 55$	XPS-25
	If $55 < B < 108$	XPS-65
	If $B > 108$	⚡
<b>REGENERATIVE REGULATED POWER SUPPLIES</b>	If $B < 26$	RPS-20
	If $26 < B < 59$	RPS-45
	If $59 < B < 97$	RPS-75

⚡ Until reaching the peak power demanded from the power supply. All the required power cannot be supplied and a second power supply will be needed.

**Very important:** When using two power supplies on the same machine, they must make up two independent groups with their own drives. Only the SERCOS® ring (if there is one) may be common to both groups.

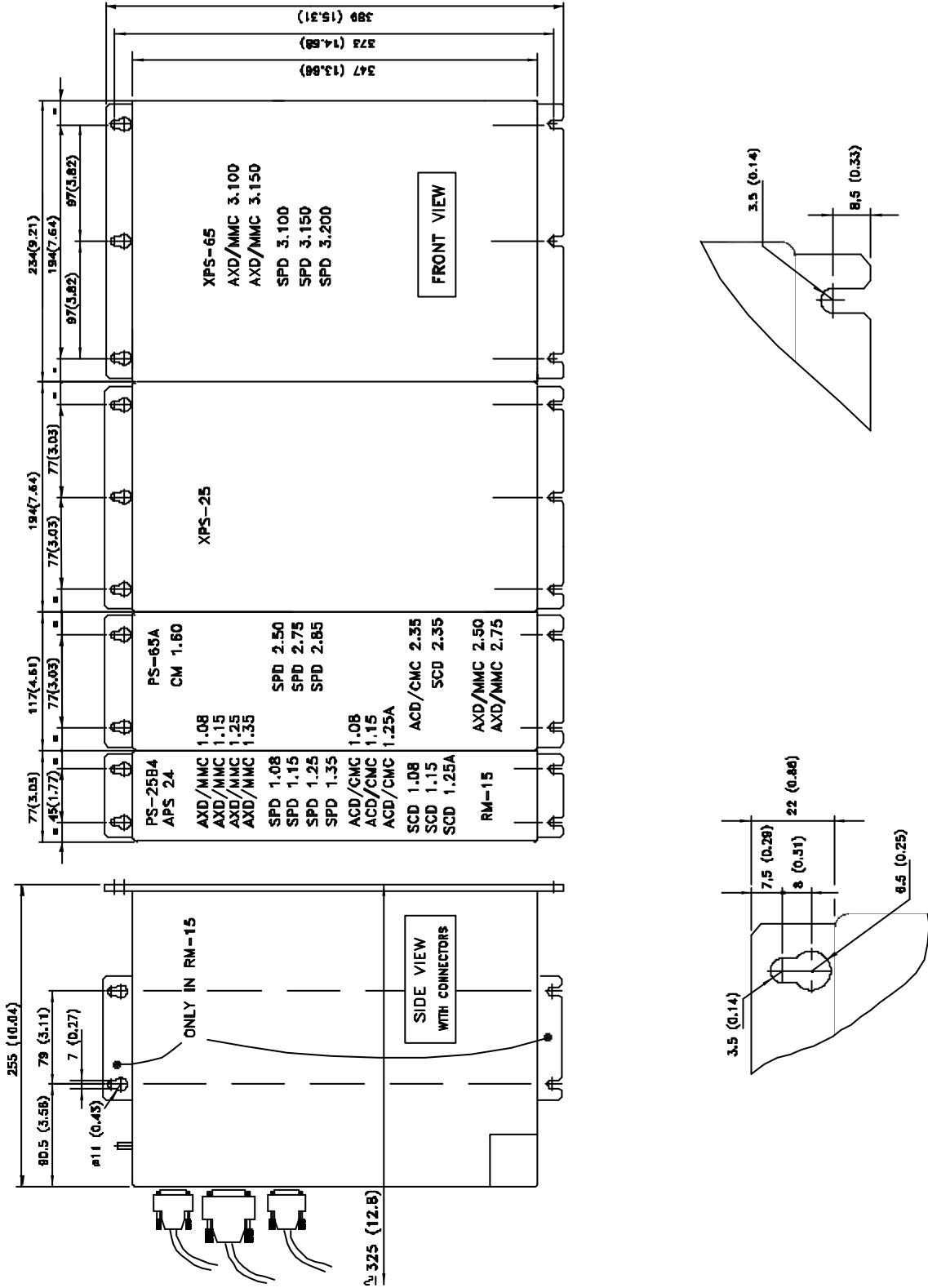
⚡ If the peak power required by the set is greater than 108 kW for XPS power supplies or greater than 97 kW for RPS power supplies, the set of motors and drives must be divided into groups and powered by different power supplies.

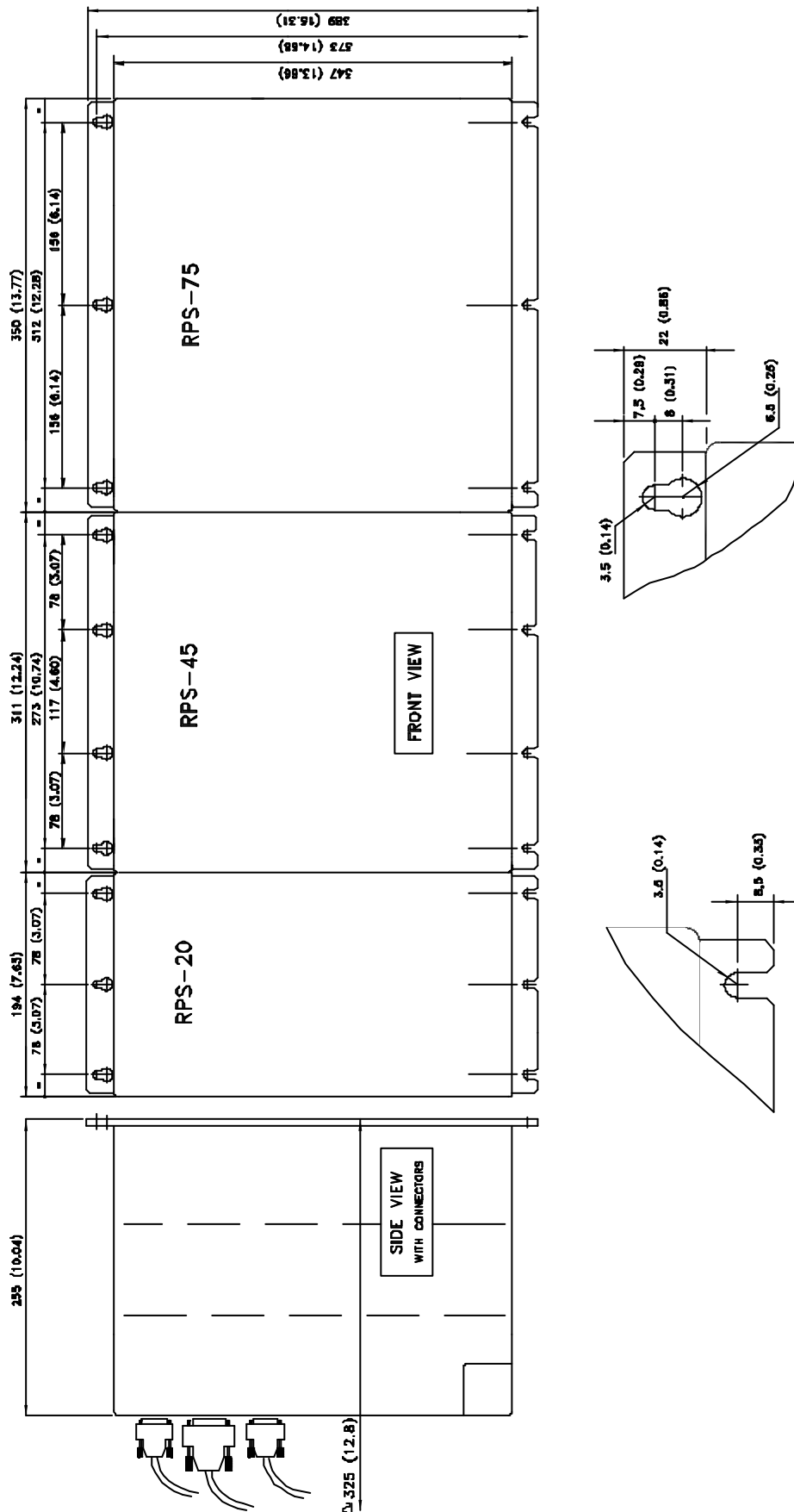


**WARNING: Never connect the power supplies in parallel !**

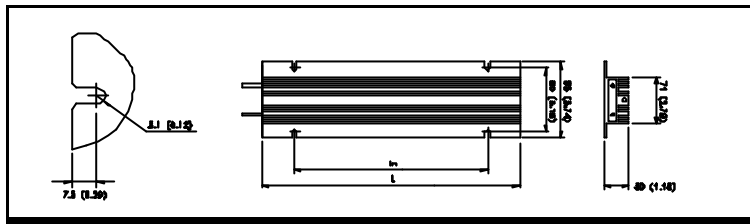
# Dimensions

Dimensions of the Drive modules in mm (in inches).

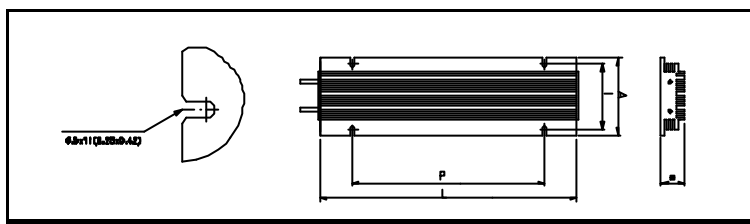




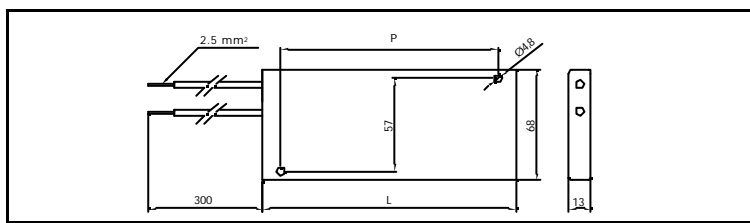
**External Resistor - ER -**



	ER-43/350		ER-24/750		ER-18/1100	
	mm	inches	mm	inches	mm	inches
<b>ln</b>	60	2.36	140	5.51	240	9.44
<b>L</b>	110	4.33	220	8.66	320	12.59



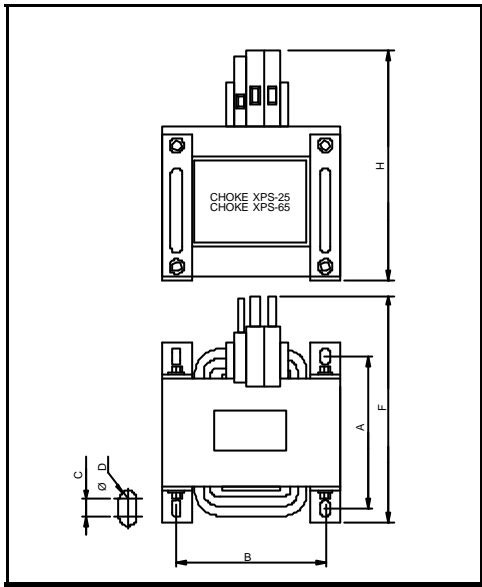
	ER-18/1800		ER-18/2200	
	mm	inches	mm	inches
<b>A</b>	120	4.72	190	7.48
<b>B</b>	40	1.57	67	2.63
<b>L</b>	380	14.96	380	14.96
<b>I</b>	107	4.21	107	4.21
<b>P</b>	300	11.81	300	11.81



	ER-33/550		ER-18/900	
	mm	inches	mm	inches
<b>P</b>	81	3.18	124	4.88
<b>L</b>	102	4.01	145	5.701

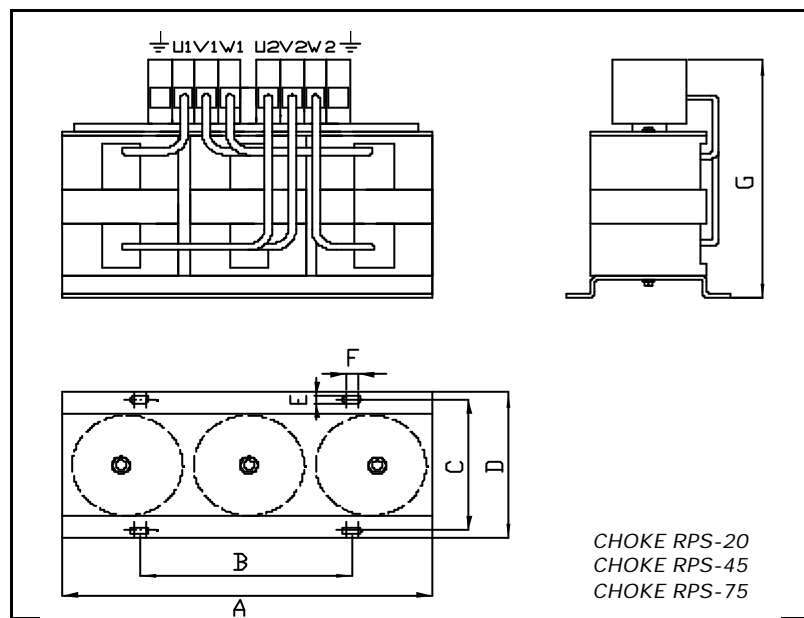


**Chokes - for XPS power supplies -**



	CHOKE XPS-25		CHOKE XPS-65	
	mm	inches	mm	inches
A	115	4.52	156	6.14
B	105	4.13	150	5.90
C	10	0.39	9	0.35
D	9	0.35	9	0.35
H	165	6.49	230	9.05
F	180	7.08	230	9.05

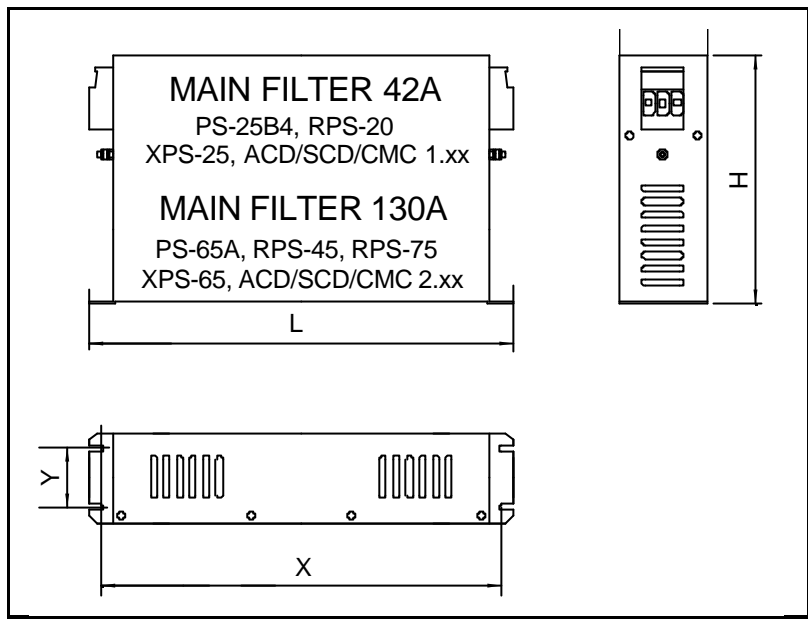
**Chokes - for RPS power supplies -**



CHOKE RPS-20  
 CHOKE RPS-45  
 CHOKE RPS-75

	CHOKE RPS-20		CHOKE RPS-45		CHOKE RPS-75	
	mm	inches	mm	inches	mm	inches
A	330	12.99	330	12.99	380	14.96
B	175	6.88	175	6.88	235	9.25
C	136	5.35	136	5.35	152	5.98
D	150	5.90	150	5.90	170	6.69
E	8	0.31	8	0.31	9	0.35
F	15	0.59	15	0.59	18	0.70
G	162	6.37	228	8.97	271	10.66

**Mains filter - DLC -**



	MAIN FILTER 42A		MAIN FILTER 130A	
	mm	inches	mm	inches
L	330	12.99	440	17.32
W	70	2.75	110	4.33
H	185	7.28	240	9.44
X	314	12.36	414	16.29
Y	45	1.77	80	3.14

