PL 1 – Electromechanical systems – Power supplies in electric circuits

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Objectives: Identification of the circuit´s electrical power requirements
Characterization of the main parameters of DC power supplies
Specification of a power supply for an electro-pneumatic circuit.

Documents available: PL classes
1) SMC-SYJ_5PT.pdf
2) Power supplies for industrial use_ rail mounting_ABLM1A24025.pdf
3) Power supplies for industrial use_ rail mounting_ABL8FEQ24020.pdf
4) TEK 1KW-60035-3_Power_Supply_Selector_Guide_080922.pdf
5) TEK Ser2200LinPwrSuppySpecsAppNote.pdf
Web sites: https://uk.tek.com/dc-power-supply
https://www.se.com/ww/en/work/products/industrial-automation-control/
http://pt.rs-online.com/web/

1. Consider the electrical supply requirements for the control circuit of an electro-pneumatic system that uses SMC solenoid valves, SYJ3000 series.

a. Identify the electric power supply characteristics of these valves, by referring to the document (SMC-SYJ_5PT.pdf).

DC: 3, 5, 6, 12 ou 24 V

AC: 100, 110, 200 ou 230 V , +/10%____

(Power @ 230V: 1.42VA)

Power consumption (W)	DC	Standard	0.35 (With light: 0.4)
		With power saving circuit	0.1 (With light only)
Apparent power (VA) *	AC	100 V	0.78 (With light: 0.81)
		110 V [115 V]	0.86 (With light: 0.89) [0.94 (With light: 0.97)]
		200 V	1.18 (With light: 1.22)
		220 V [230 V]	1.30 (With light: 1.34) [1.42 (With light: 1.46)]

b. Interpret each of the fields of the specification code for one of these valves:

SYJ3	1	2	0		-	5	M	Z	D	-	M3	F	-	Q
	i)	ii)	iii)	iv)		v)	vi)	vii)	viii)		ix)	x)		xi)

i) _2 positions, one coil

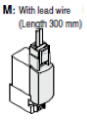
ii) Body ported

iii) 0: Pilot valve individual exhaust for the pilot valve

iv) Coil specifications: Nil – Standard

v) _____

vi) M plug connector



vii) Z | With light/surge voltage suppressor

viii) D: Push-turn locking slotted type

ix) *Port size* (tamanho válvula)

x) valve fixing system

xi) CE *compliant*

2. Based on the document (Power supplies for industrial use_ rail mounting_ABLM1A24025.pdf) corresponding to information regarding a power supply from the manufacturer Schneider-Electric, indicate:

a. Does this power supply meet the power supply requirements of the SMC-SYJ3000 solenoid valves?__ Yes, 24 V,60 W, compatible with 24V DC coils

b. How many of these valves can be included in a circuit that is powered by this source?___150 valves (60 W / 0.4 W)_

Analyse and indicate other characteristics of this power supply that can be identified from the available document:

- Basic principle and working mode:__switch mode, regulated

- Stability with temperature variation: ___-25ºC até 55ºC __

- Influence of load variations: (*load regulation*) +/- 3% (24V * 3% = 0.72V)

- Influence of variations in power supply input power: (line regulation)+/- 3%
- Stability of output signal: Ripple 200 mV
- Power supplies association: Yes, serial ou parallel
- Size dimensions and weight: 0,255 kg ; 74X59X110 mm (model ABL 7RM24025)-
- Power supply costs: ~80 €
- Field of application: general use

3. Other manufacturers, Legrand, also offers several alternatives for DC sources. The document (Legrand047022-ProductSheet.pdf) contains information regarding one of these alternatives.

a. Analyse some of the features you consider most relevant compared to the previous power supply (Ex.2):

Linear power supply, rectified and filtered

Single phase powered

Output: 24V DC, 2.5A, (60W)

Dimensions 90x121x105 mm

Price~~408 + IVA€

b. Does this power supply also meet the power requirements of the solenoid valves mentioned above? Justify Yes. 60 W/ (0,4 W per coil) = 150 coils

4. The DC power supplies analysed previously can be included in the category for general application, but that also can satisfy specific objectives of control circuits in automation systems. The documents (TEK 1KW-60035-3_Power_Supply_Selector_Guide_080922.pdf, TEK Ser2200LinPwrSuppySpecsAppNote.pdf) contain information regarding other more sophisticated DC power supplies alternatives available from the manufacturer Keithley-Tektronix. Based on the analysis of these documents, indicate some of the characteristics that allow you to differentiate these PS compared to the PS analysed previously:

Workbench power supplies, no to be used in electrical cabinets

Programmable power supplies> selection of voltage, current, power limitation, impulse generator, screen interface to display data

Low ripple and noise

accuracy:

- voltage (V), 0,05% of programmed voltage

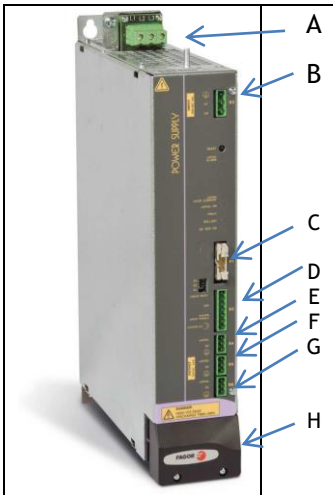
-current (I), 0,2% of programmed current

High cost (model PS2000 (up to 192W) price starting on 450€)

5. The figure below corresponds to the power supply of the modular CNC that controls a YX positioning table. Several connectors with different functions can be identified in the PS

source. Making a correspondence between the figure and the analysis carried out in the installation of this equipment, complete the identification of the connectors indicated in the figure.

Modular power supply, Fagor PS-25B4



Technical characteristics		
Power supply (V mains, 3 phase, 56/60 Hz)	[V AC]	400-15% to 460+10%
Mains power consumption (400 V AC)	[A_{rms}]	38
Power bus voltage (nominal)	[V DC]	567.5-650
Rated output current	[A]	45
Peak output current (1 s)	[A]	135
Rated output power	[kW]	25
Peak output power (1 s)	[kW]	75
Approx. mass	[kg]	6
Size (width x height x depth)	[mm]	77 x 348 x 255

A	(X2): three phase input
B	(X3): single phase input
C	(X1): Connector bus for communication between DDS modules
D, E, F, G	Auxiliary power supply (24 V DC) connectors for control of the circuit and other modules
H	Protection cover cap. DC power output bus (0,600 V DC)

6. Consider the image shown below, relative to the control cabinet of the cartesian manipulator in the Robotics lab.

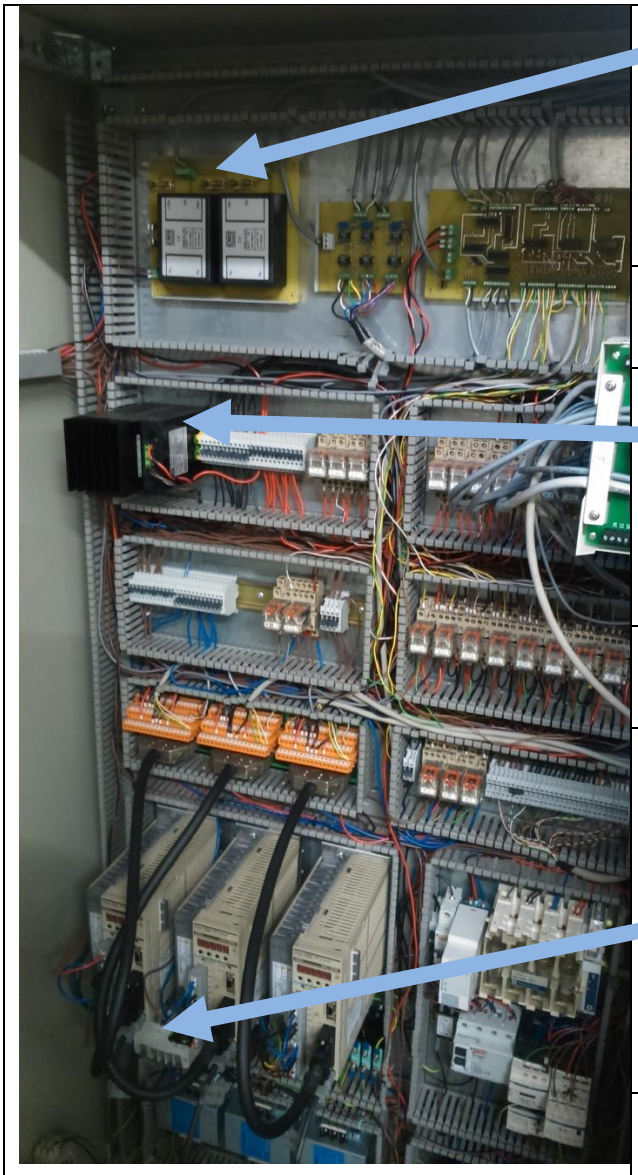
Identify the following power supplies in the figure:

A. Power supply, 24 V DC, 2A (control circuit, relays, limit switches)

B. Power supply, +/- 15 V DC, 200 mA (accelerometer signal processing circuit)

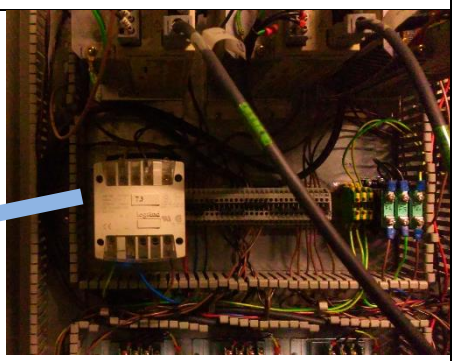
C. Power supply, +5 V DC, 1000 mA (accelerometer signal processing circuit)

D. Power supply, 24V AC, 100 VA (control circuit, contactors, relays)



B, C

A



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