

6. Selection guide for piezo drivers

6.1 Selection guide

6.1.1 Introduction

The driving electronics of the APA®, MLA or PPA Actuators are based on the 75 family of 19 inches electronic boards. Versatile systems can therefore be designed from 19 inches racks including at least:

- ◆ An AC/DC or a DC/DC converter necessary to produce high DC voltage,
- ◆ An amplifier to drive the piezoelectric actuator generally between -20V and 150 V.

If a fine positioning is required, it may be necessary to use a closed loop (please see section 7):

- ◆ A position sensor and its electronics,
- ◆ A force sensor or an accelerometer and its electronics,
- ◆ A closed loop servo controller.

Please do not hesitate to contact us by phone or at actuator@cedrat.com.

Model serie	Unit	CAu10	CA45	LC75	LA75	SP75
Notes		-	-	-	-	-
Function		Standalone voltage amplifier	Standalone voltage amplifier	Bipolar AC/DC linear converter	Linear amplifier	Switching power stage
Main or supply voltage	V	5 ... 15 VDC	240 VAC [e]	240 VAC [e]	-20 / 150 VDC [a,b,f]	-20 / 150 VDC [a,d,f]
Output voltage	V	5 ... 150	-20 ... 150	-35 / 165 -15/15/12/5	-20 ... 150	-20 / 150
Number of channels		2 + push-pull	1		1 to 3 (push-pull option for A & B)	1 to 2

Table 6.1: Compatibility of driving electronic sub-system of the 75 family

The technical information on this leaflet is not contractual and can be changed without prior notice.

6.1.2 Rack dimensions

Four standard racks are used to build the customer's configuration starting from 19 inches boards (Figure 6.1). Multiple configurations can be customised from those racks. Figure 6.2 shows for instance an RK84F rack, including 3 LA75B-2 boards, 1 SG75-3 board and 1 UC45 interface (see also section 7).

References	Unit	RK12	RK42F3U	RK63F4U	RK84F4U
<i>Notes</i>					
Weight [°]	kg	1.4	4.65	9.5	6.6
Width	mm	89	260	365	470
Height	mm	129	160	200	200
Depth	mm	260	310	310	310
[*] transformers included, cards not included					

Table 6.2: Rack characteristics

Figure 6.1: View of Standard racks



Figure 6.2: Customised rack including 6 channels & 3 closed loop



Figure 6.3: Main Selector for racks (example)

6.1.3 Connections

The connection to the main is performed through a CEE22 connector including a 110V/230V selection (figure 6.3). The high voltage cables used to drive the Piezo Actuators are ended by LEMO FFA.00.250.CTAC22 connectors. It terminates on the actuator's side by two-banana plug $\varnothing 1\text{mm}$ (figure 6.4.a). They can be changed on request for specific applications or environments. Alternatively, a LEMO-BNC converter can be proposed (figure 6.4b).

The strain gauges cable for APA® uses a flex connection and a SMD 1mm pitch SMT connector (figure 6.5).

For electrical push pull operation of two actuators, a specific cable is delivered by CEDRAT TECHNOLOGIES in order to connect the two pairs of banana plug to a single LEMO channel.



Figure 6.4a: Standard coaxial cable RG178B/U to drive APA™ Actuator



Figure 6.4b: LEMO – BNC converter



Figure 6.5: Cable to drive a Strain Gauges sensor

6.1.4 Standard configurations

The most standard configurations are displayed on Table 6.3 and correspond to:

- ◆ Up to 3 low bandwidth channels (operating in closed-loop option) in an RK42F rack,
- ◆ Up to 2 medium bandwidth channels (operating in closed-loop option) in an RK42F rack,
- ◆ One large bandwidth channel (operation in closed-loop option) in an RK63F rack,
- ◆ Up to 5 low bandwidth channels (operating in closed-loop option) and a display interface controller in a RK84F4U rack,
- ◆ Up to 15 low bandwidth channels in a RK84F4U rack.

Other combinations are possible: please consult CEDRAT TECHNOLOGIES.

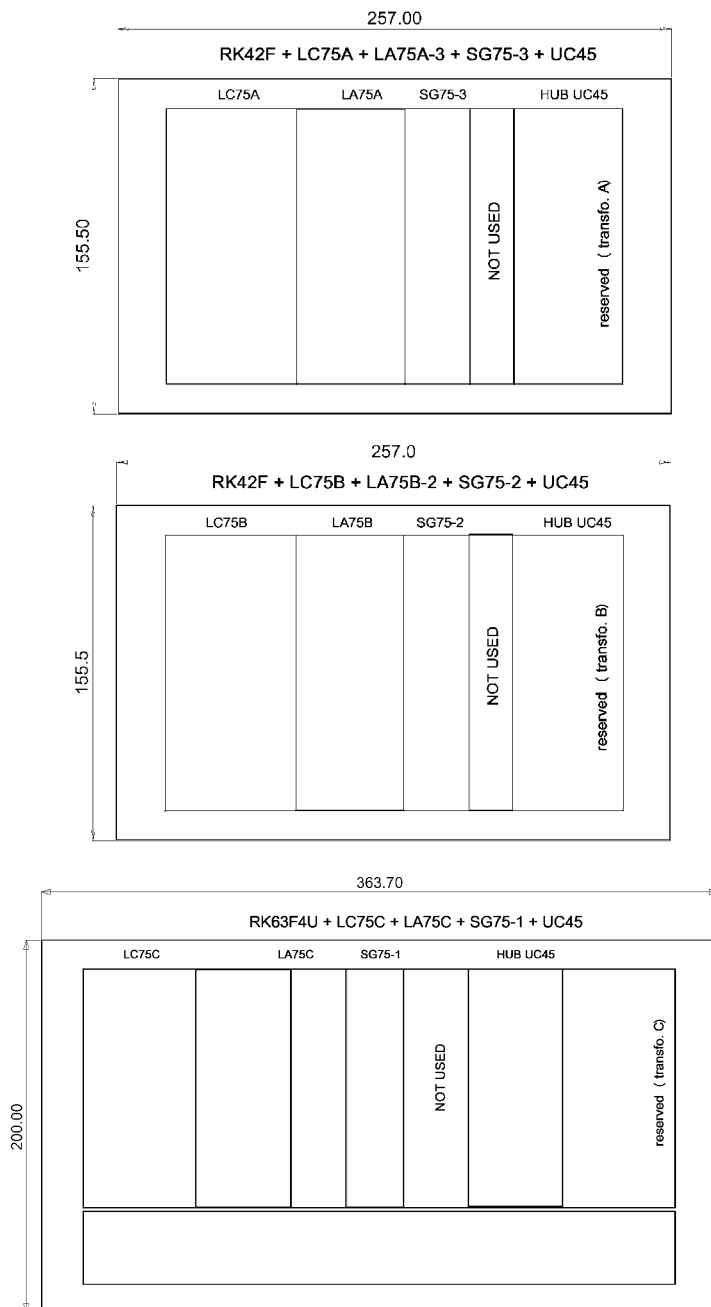
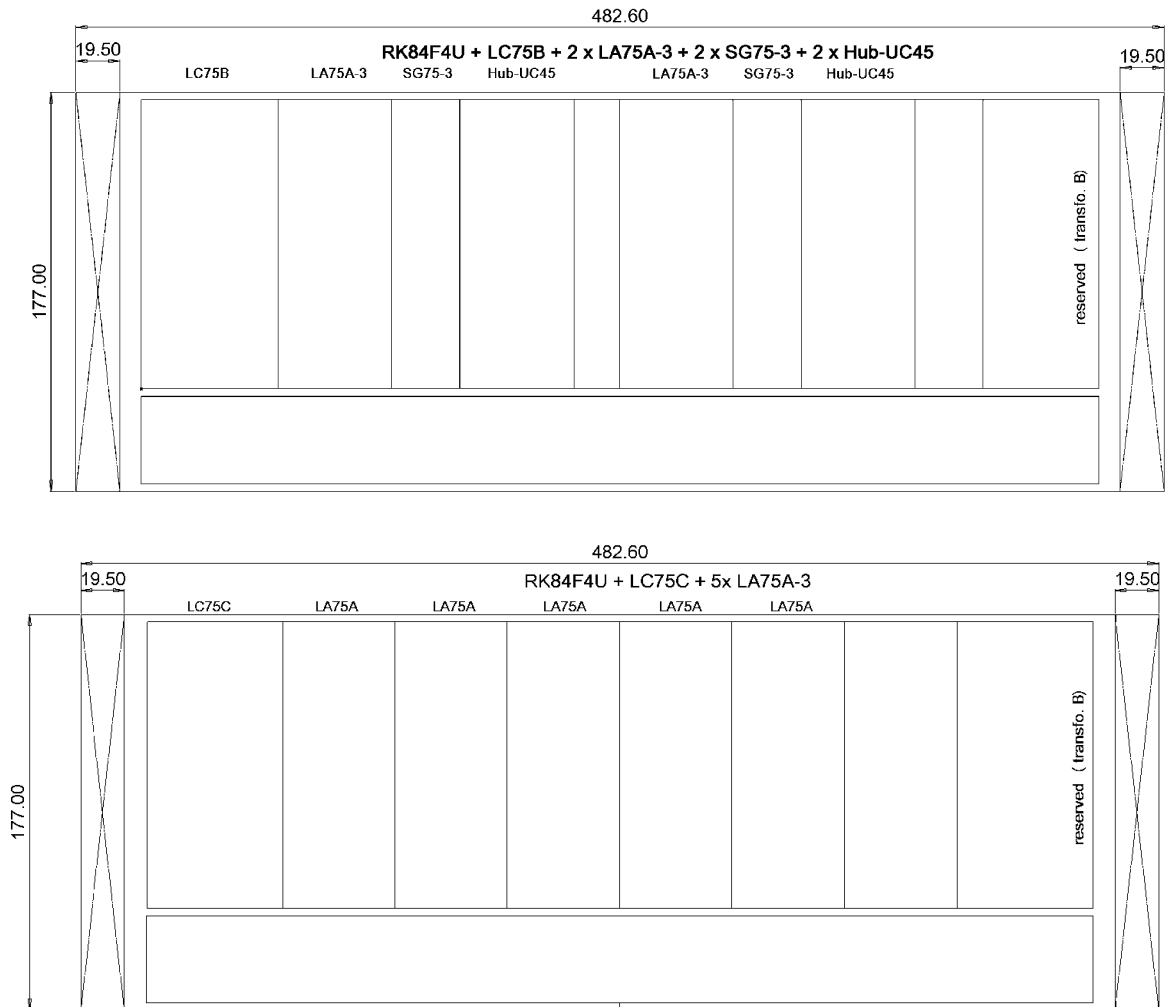


Table 6.3: Overview of the standard configurations



6.1.5 Notes

The following technical data sheets refer to the notes here-below.

- [a] May be limited by a high-frequency excitation.
- [b] May be limited if several channels are used.
- [c] Adjustable during the tests acceptance process.
- [d] May be limited by the power supply.
- [e] 110 VAC upon request.
- [f] Requires a DC/DC or an AC/DC converter.
- [g] Transformers mounted on the rack.
- [h] Per channel.
- [i] On 1.55 μ F.
- [j] Other possible voltage ranges.
- [k] At 20V pk-pk.

6.2 Miniature Amplifiers for piezo actuator

The CAu10 and CA25 cards are standalone amplifiers. The CAu10 is an extra-miniature two-channels Amplifier for piezo actuators in open loop, which is able to deliver 5 mA and requires a DC voltage of 3.3 to 15 V. The command can be analogue or numerical (SPI format).

References	Unit	CAu10
Item Code		V-CAU10
Notes		-
Function		Standalone voltage amplifier board
Cooling		Natural convection
Main voltage [e]	VDC	5 ... 15
Output voltage	V	5 ... 150
Quiescent current	mA	0.9
Maximal output current [a]	A	5.00E-03
Maximal output power (peak) [a]	VA	1.0
Max. output load capacitance	μ F	40
Control input voltage	V	0 ... 3,3
Signal to noise ratio [k]	dB	70
Output bandwidth [f]	Hz	8.6
Gain	V/V	45
PZT connector		Hirose 5 points pitch 1.25 mm
External Control Input		Hirose 8 points pitch 1.25 mm
Input impedance	kOhms	10
Weight	kg	2.20E-03
Dimensions	mm	27*25*7

Table 6.4: Characteristics of the CAu10 compact amplifier



Figure 6.5: View of the miniature CAu10 amplifier

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6.3 Compact Amplifier for piezo actuator

The CA45 is a standalone one channel amplifier encased in an RK12 small rack. The CA45 is connected to the main source (220/240 VAC, 110 VAC upon request) and provides all the necessary functions to obtain the highest accuracy from a piezo actuator:

- ◆ Drive of a piezo actuator in open loop,
- ◆ Control in open or closed loop of a piezo actuator equipped with Strain Gauges (SG option), and with the numerical servo controller (UC45 option).

OEM version can be customised upon request.

References	Unit	CA45
Item Code		V-CA45
Notes		-
Function		Standalone voltage amplifier
Cooling		Natural convection
Main voltage [e]	VAC	230
Output voltage	V	-20 / 150
Quiescent current	mA	2.0
Maximal output current [a]	A	0.036
Maximal output power (peak) [a]	VA	4.50
Max. output load capacitance	μ F	400
Control input voltage	V	-1 ... 7.5
Signal to noise ratio [k]	dB	85
Output bandwidth [j]	Hz	61.6
Accuracy (SG option)	%	0.1
Accuracy (ECS option)	%	0.01
PZT connector		LEMO ERN.00.250.CTL
External Control Input		BNC / 50 Ohms
Input impedance	kOhms	10
Weight	kg	1.2
Dimensions	mm	12F wide, 3H high

Table 6.5: Characteristics of the CA45 compact amplifier



Figure 6.6: View of the compact CA45 amplifier

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6.4 75 series AC/DC Converters

AC/DC or DC/DC converters of the 75 family are designed to produce stabilised DC voltages which are necessary to supply the amplifiers. AC/DC converters use the mains as primary source. The LC75A AC/DC converter is used in the standard configuration, while the LC75B and the LC75C converters have a higher current capability and may be used for impulse and/or high frequency applications.

OEM version can be customised on request.

References	Unit	LC75A	LC75B	LC75C
Item Code		V-LC75A	V-LC75B	V-LC75C
Notes		-	-	-
Function		Bipolar AC/DC linear converter	Bipolar AC/DC linear converter	Bipolar AC/DC linear converter
Cooling		Natural convection	Forced air	Forced air
Main voltage [e]	VAC	230	230	230
Main frequency	Hz	50	50	50
Output voltage [j]	VDC	-36 / 165	-36 / 165	-36 / 165
Current limitation	A	0.12	0.6	2.4
Maximal output power (peak)	VA	19.8	99	396
Rear interface		DIN41612 32 pin	DIN41612 32 pin	DIN41612 32 pin
Weight	kg	0.68	0.68	0.68
Dimensions [g]	mm	12F wide, 3H high	12F wide, 3H high	12F wide, 3H high

Table 6.6: Characteristics of the LC75 converter



Figure 6.7: View of the LC75B amplifier

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6.5 LA75 Linear Amplifier series

The LA75 series of linear amplifier offers the most usual solution to drive Piezo Actuators. The Linear Amplifier LA75 is designed to drive capacitive loads like Piezoelectric Actuators with extremely low noise. LA75A-x is a low-power amplifier implanted on a 19' board and can have up to 3 independent channels. It can perform amplifying operations in the -20/150 V range. LA75B-x is a medium power amplifier implanted on a 19' board and can have up to 2 independent channels. It can perform amplifying operations in the -20/150 V range. The LA75A-x and LA75B-x can be equipped with the push pull option.

The LA75C has a much higher current capability, especially for high frequency and/or impulse applications. It shows the highest power capability of the linear amplifiers available on the market. See Table in section 8.2.2 for a bandwidth comparison of these linear amplifiers.

Inductive tuning is a possible method to reduce the apparent reactive power in some dynamic applications: please consult CEDRAT TECHNOLOGIES.

OEM versions can be customised upon request.

References	Unit	LA75A-x	LA75B-x	LA75C
Item Code		V-LA75A-1	V-LA75B-1	V-LA75C
Notes		x : number of channel	x : number of channel	-
Function		Linear amplifier	Linear amplifier	Linear amplifier
Max. number of channels		3	2	1
Cooling		Natural convection (Forced convection for 3 channels)	Natural convection (Forced convection for 2 channels)	Forced air
Supply voltage [j]	VDC	-35 / 168	-35 / 168	-35 / 168
Output voltage [j]	V	-20 ... 150	-20 ... 150	-20 ... 150
Quiescent current	mA	2.0	2.0	10.0
Maximal output current[a,b,d,h]	A	0.09	0.36	2.4
Maximal output power (continuous) [a,b,d,h]	VA	15	61	510
Max. output load capacitance	μ F	400	400	400
Control input voltage	V	-1 ... 7.5	-1 ... 7.5	-1 ... 7.5
Signal to noise ratio [k]	dB	85	85	85
Output bandwidth [l]	Hz	154	616	4107
DC offset setting		10 turn potentiometer	10 turn potentiometer	10 turn potentiometer
PZT connector		LEMO ERN.00.250.CTL	LEMO ERN.00.250.CTL	LEMO ERN.00.250.CTL
External Control Input		BNC / 50 Ohms	BNC / 50 Ohms	BNC / 50 Ohms
Input impedance	kOhms	10	10	10
Rear interface		DIN 41612 FormeC 64/96	DIN 41612 FormeC 64/96	DIN 41612 FormeC 64/96
Weight	kg	1	1	0.86
Dimensions	mm	10F wide, 3H high	10F wide, 3H high	18F wide, 4H high

Table 6.7: Characteristics of the LA75 amplifier



Figure 6.8: View of the LA75B-2 amplifier

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6.6 SP75 Switching Power

The switching power is designed to be compatible with the 75 rack family and to perform ON/OFF operations on Piezo Actuators, allowing extremely fast actuations. The switching technique allows high current peaks, required by impulse applications. Only two positions can be obtained:

- ◆ OFF position at rest (0 or -20 Volt),
- ◆ ON position (150 Volt DC).

The two positions are controlled by a TTL signal. The overshoot of the Piezo Actuator can be reduced by the electronics after some calibrations or by a current limitation or by the Mechanical Damping (MD) option on the APA™. The SP75A-x and SP75B-x can be equipped with the Push Pull option.

OEM version can be customised upon request.

References	Unit	SP75A-x	SP75B-x
Item Code		V-SP75A1	V-SP75B1
Notes		<i>x : number of channel</i>	<i>Preliminary data x : number of channel</i>
Function		Switching power stage	Switching power stage
Max. number of channels		2	2
Cooling		Natural convection	Forced air
Supply voltage	VDC	-20 / 150	-20 / 150
Output voltage	V	-20 / 150 or 0 / 150	-20 / 150 or 0 / 150
Maximal output current (peak) [a]	A	0.36	3
Max. output load capacitance	μF	400	400
Logic control input voltage	V	TTL signal / CMOS	TTL signal / CMOS
Output bandwidth	Hz	968	8065
PZT connector		LEMO ERN.00.250.CTL	LEMO ERN.00.250.CTL
External Control Input		BNC / 50 Ohms	BNC / 50 Ohms
Input impedance	kOhms	10	10
Rear Interface		Din 41612 FormeC 64/96	Din 41612 FormeC 64/96
Weight	kg	0.5	0.5
Dimensions	mm	10F wide, 3H high	14F wide, 3H high

Table 6.8: Characteristics of the SP75 switching power



Figure 6.9: View of the SP75A-1 switching power

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