



The **A1422** series are charge sensitive preamplifiers, available with either **1, 4 or 8** channels. Various sensitivity values are available and various detectors capacitances are supported:

- **F2 type:** up to 200 pF
⇒ sensitivity: **5, 45, 90, 400 mV/MeV (Si)**
- **F3 type:** up to 1000 pF
⇒ sensitivity: **5, 45, 90 mV/MeV (Si)**

All of them can be used in nuclear and subnuclear physics experiments, where very low noise, fast response and high counting rates are required. The modules accept both positive and negative input charge pulses and provide an energy output of ± 3.5 V range on 50 Ω termination (± 8 V on 1k Ω). Moreover, a test input accepts positive and negative signals for calibration purposes.

The hybrid preamplifiers are realized using a Cold Discharge Mechanism: this allows to have a low decay time value maintaining a very high feed resistance value. This technique provides good performances minimizing the pile-up in presence of moderate high counting rates.

The A1422 are implemented into alloy boxes and feature **SHV** connectors for the IN/DETECTOR and HV BIAS signals, **LEMO** connectors for the TEST IN and ENERGY OUT and a cable with a **D-type** 9 pin male connector for the power supply.

- Alloy box
- Fast, low noise inverting preamplifier
- Positive or negative input signals
- Four available gain values:
 - 5 mV/MeV (Si)
 - 45 mV/MeV (Si)
 - 90 mV/MeV (Si)
 - 400 mV/MeV (Si)
- Up to 1000 pF detector capacitance supported
- 1, 4 and 8 channel model available
- Up to 2000 V (positive or negative) detector bias voltage
- Low noise input stage composed JFETs diode protected

Specification

Charge Sensitivity

5 mV/MeV (Si)
45 mV/MeV (Si)
90 mV/MeV (Si)
400 mV/MeV (Si) (only F2)

Recommended Range Of Input Capacitance

F2: up to 200 pF
F3: up to 1000 pF

Noise FWHM keV (Si) ⁽¹⁾

Model	Detector capacitance	
	0 pF	200 pF
F2 - 5 mV/MeV	< 6.6	< 9.7
F2 - 45 mV/MeV	< 1.9	< 4.3
F2 - 90 mV/MeV	< 1.8	< 4.3
F2 - 400 mV/MeV	< 2.0	< 3.6
Model	390 pF	1000 pF
F3 - 5 mV/MeV	< 10.6	< 15.2
F3 - 45 mV/MeV	< 6.5	< 11.5
F3 - 90 mV/MeV	< 5.9	< 11.3

Rise Time ⁽²⁾

Model	Detector capacitance	
	0 pF	200 pF
F2 - 5 mV/MeV	< 10 ns	< 20 ns
F2 - 45 mV/MeV	< 10 ns	< 35 ns
F2 - 90 mV/MeV	< 10 ns	< 75 ns
F2 - 400 mV/MeV	< 35 ns	< 110 ns
Model	390 pF	1000 pF
F3 - 5 mV/MeV	< 20 ns	< 35 ns
F3 - 45 mV/MeV	< 45 ns	< 90 ns
F3 - 90 mV/MeV	< 100 ns	< 220 ns

Output Linear Range

± 8 V 1 k Ω termination
 ± 3.5 V 50 Ω termination

Integral non Linearity

< $\pm 0.05\%$ ($0 \div \pm 8$ V 1 k Ω termination)

Temperature Instability

< ± 100 ppm/ $^{\circ}\text{C}$ (0 to 50°C)

Open Loop Gain

F2 (except 400 mV/MeV) > $2 \cdot 10^5$
F2 - 400 mV/MeV > $1 \cdot 10^6$
F3 > $4 \cdot 10^5$

E²CRP Maximum energy-squared count-rate product

Sensitivity	E ² CRP
5 mV/MeV (Si)	$3.02 \cdot 10^8$ MeV ² /s
45 mV/MeV (Si)	$1.11 \cdot 10^8$ MeV ² /s
90 mV/MeV (Si)	$1.68 \cdot 10^7$ MeV ² /s
400 mV/MeV (Si)	$3.41 \cdot 10^6$ MeV ² /s

Decay Time

5 mV/MeV (Si)	270 μs
45 mV/MeV (Si)	110 μs
90 mV/MeV (Si)	150 μs
400 mV/MeV (Si)	14 μs

Detector Bias Voltage

± 2000 V max

Packaging

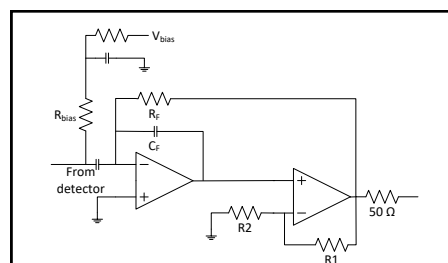
Alloy Box

Dimensions (WxHxD connector included):

A1422Axxxx (1 ch): 40.0 x 30.0 x 124 mm³
A1422Bxxxx (4 ch): 100.0 x 50.0 x 162 mm³
A1422Cxxxx (8 ch): 100.0 x 50.0 x 162 mm³

(1) Measured with a CAEN N968 Spectroscopy Amplifier and N957 Peak Sensing ADC shaping time: 3 μs .

(2) Test input rise time: 1.6 ns, amplitude: 200 mV 50 Ω termination



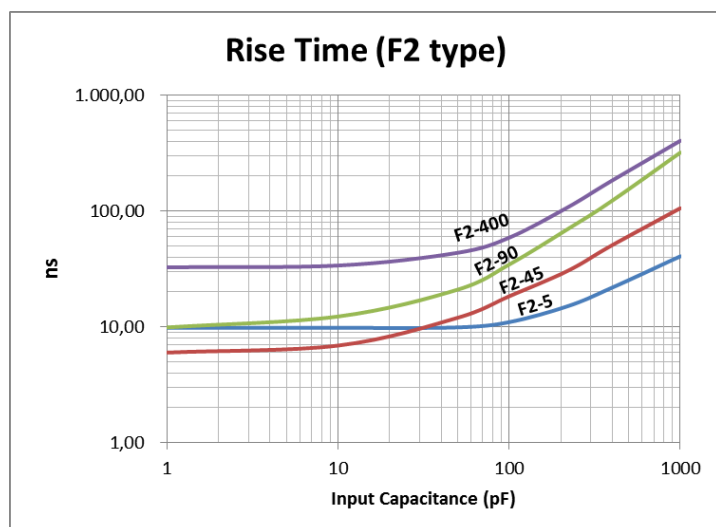


Fig. 1 : Typical Rise Time vs input Capacitance (test input rise time = 1.6 ns, amplitude: 200 mV, 50 Ω termination)

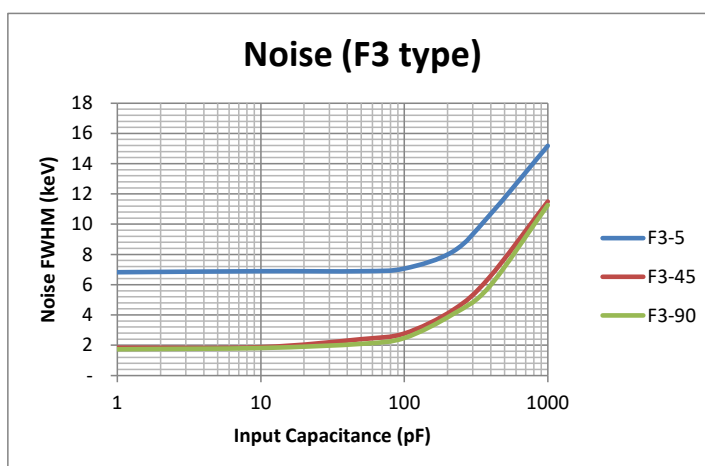
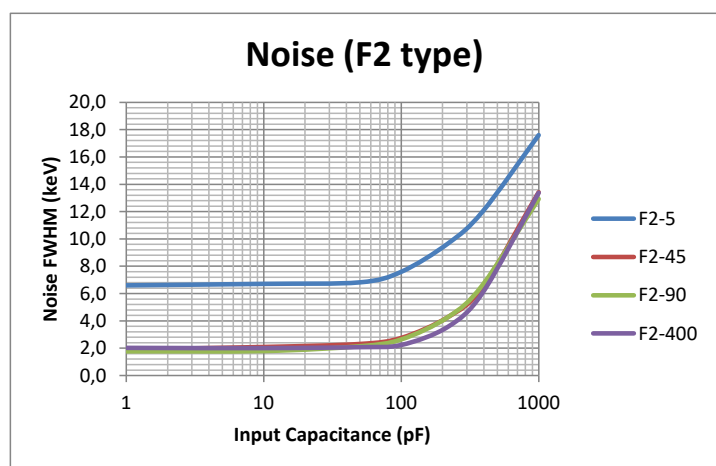


Fig. 2: Maximum Noise vs input Capacitance

Inputs

DET/IN

Accepts positive and negative input charge pulses from semiconductor detectors and supplies the HV bias to the detector itself; **SHV** connector.

HV/IN

Up to 2000 V (positive or negative) for the detector bias. 100 M Ω resistance in series (other on request); **SHV** connector (**BNC** on request).

TEST IN

Positive or negative input for the energy calibration via Ctest = 1 pF or 10 pF (on 5 mV/MeV versions); **LEMO-00** connector.

Power

Input Power through a 2.1 m cable with a **D-type 9 pin** male connector.

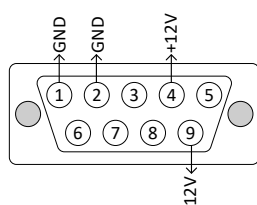


Fig. 3: Power Supply Connector pin out

Outputs

E OUT

± 8 V max. (open circuit), 50 Ω back termination. The output voltage is proportional to the amount of input charge.

Connector:

- A1422A (1 ch): **BNC**
- A1422B/C (4/8 ch): **LEMO-00**

The typical rise time is

Detector capacitance = 0 pF

< 10 ns F2 - 5/45/90 mV/MeV

< 35 ns F2 - 400 mV/MeV

Detector capacitance = 390 pF

< 20 ns F3 - 5 mV/MeV

< 45 ns F3 - 45 mV/MeV

< 100 ns F3 - 90 mV/MeV

Adjacent Channel Crosstalk (4/8 ch) = -40 dB with reverse polarity

Power Requirements

Models

	+12 V	-12 V
A1422AxxxF2 (1 ch):	14 mA	6 mA
A1422BxxxF2 (4 ch):	55 mA	25 mA
A1422CxxxF2 (8 ch):	105 mA	50 mA

	+12 V	-12 V
A1422AxxxF3 (1 ch):	24 mA	6 mA
A1422BxxxF3 (4 ch):	80 mA	25 mA
A1422CxxxF3 (8 ch):	160 mA	50 mA

The power supply can be provided by CAEN Spectroscopy Amplifier **N968** (via a D-type female connector on the rear-panel) or **DT5423** Desktop Linear Power Supply.

⚠️ WARNING During normal operation, a potentially hazardous high voltage bias is applied to a detector via the preamplifier.

Only qualified personnel should carry out installation, operation and maintenance procedures of this unit.

Furthermore, the preamplifier bias circuit has a very long time constant and therefore this circuitry can remain at high voltage for a very long time. If the user does not exercise adequate caution, this voltage can cause personal injury due to electrical shock.

Please observe the following precautions:

- Completely discharge the detector bias circuit by switching off the bias supply before connecting a cable, to the Input/Detector connector.
- If you are using a variable power supply, bring the voltage value to zero and wait for at least 30-60 seconds. The bias circuitry will discharge itself through the output of the bias supply.

⚠️ WARNING Do not connect the **DET/IN** to exposed circuitry. Connect the preamplifier to a Detector/Power Supply properly grounded to safety earth.

Operation

A customization is available to improve amplifier protection from transients generated in the DET/HV network (up to ± 2200 V). Anyway care must be taken in the use of A1422 with high voltage detectors.

Please remember to:

- Turn down gradually bias voltage prior to connect or disconnect preamp input
- Avoid fast changes in bias voltage
- Avoid Detector breakdown or discharge

Panel Layout

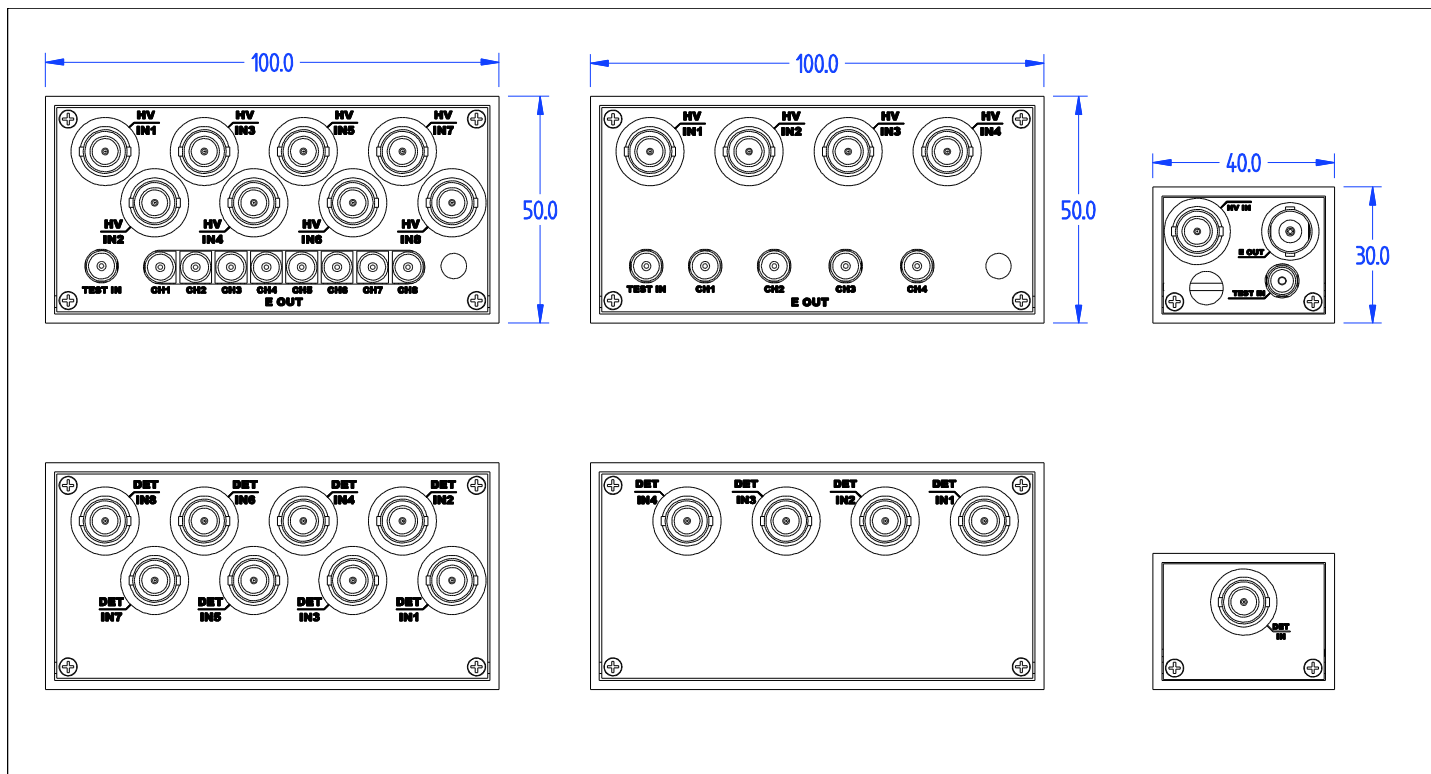


Fig. 4: A1422 series Front and Rear panel 8ch, 4ch, 1ch (dimension: mm)

Ordering Option

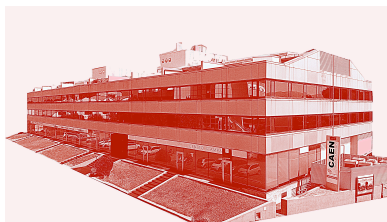
Detector capacitance pF	Gain mV/ MeV	No. of Channels	Ordering code	Description
< 200	5	1	WA1422A005F2	A1422A005F2 - 1 Ch. Charge Preamplifier, 5mV/MeVgain, Cdet<200pF
		4	WA1422B005F2	A1422B005F2 - 4 Ch. Charge Preamplifier, 5mV/MeVgain, Cdet<200pF
		8	WA1422C005F2	A1422C005F2 - 8 Ch. Charge Preamplifier, 5mV/MeVgain, Cdet<200pF
	45	1	WA1422A045F2	A1422A045F2 - 1 Ch. Charge Preamplifier, 45mV/MeVgain, Cdet<200pF
		4	WA1422B045F2	A1422B045F2 - 4 Ch. Charge Preamplifier, 45mV/MeVgain, Cdet<200pF
		8	WA1422C045F2	A1422C045F2 - 8 Ch. Charge Preamplifier, 45mV/MeVgain, Cdet<200pF
	90	1	WA1422A090F2	A1422A090F2 - 1 Ch. Charge Preamplifier, 90mV/MeVgain, Cdet<200pF
		4	WA1422B090F2	A1422B090F2 - 4 Ch. Charge Preamplifier, 90mV/MeVgain, Cdet<200pF
		8	WA1422C090F2	A1422C090F2 - 8 Ch. Charge Preamplifier, 90mV/MeVgain, Cdet<200pF
	400	1	WA1422A400F2	A1422A400F2 - 1 Ch. Charge Preamplifier, 400mV/MeVgain, cdet<200pF
		4	WA1422B400F2	A1422B400F2 - 4 Ch. Charge Preamplifier, 400mV/MeVgain, Cdet<200pF
< 1000	5	1	WA1422A005F3	A1422A005F3 - 1 Ch. Charge Preamplifier, 5mV/MeVgain, Cdet<1000pF
		4	WA1422B005F3	A1422B005F3 - 4 Ch. Charge Preamplifier, 5mV/MeVgain, Cdet<1000pF
		8	WA1422C005F3	A1422C005F3 - 8 Ch. Charge Preamplifier, 5mV/MeVgain, Cdet<1000pF
	45	1	WA1422A045F3	A1422A045F3 - 1 Ch. Charge Preamplifier, 45mV/MeVgain, Cdet<1000pF
		4	WA1422B045F3	A1422B045F3 - 4 Ch. Charge Preamplifier, 45mV/MeVgain, Cdet<1000pF
		8	WA1422C045F3	A1422C045F3 - 8 Ch. Charge Preamplifier, 45mV/MeVgain, Cdet<1000pF
	90	1	WA1422A090F3	A1422A090F3 - 1 Ch. Charge Preamplifier, 90mV/MeVgain, Cdet<1000pF
		4	WA1422B090F3	A1422B090F3 - 4 Ch. Charge Preamplifier, 90mV/MeVgain, Cdet<1000pF
		8	WA1422C090F3	A1422C090F3 - 8 Ch. Charge Preamplifier, 90mV/MeVgain, Cdet<1000pF





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