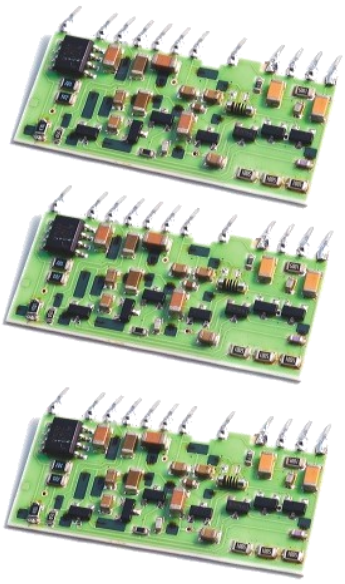
A1422H

Low Noise Fast Rise Time Charge Sensitive Preamplifier (Hybrid)

Data Sheet

The **A1422H** series are charge sensitive preamplifiers realized in Hybrid Technology. 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 1kΩ). 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.

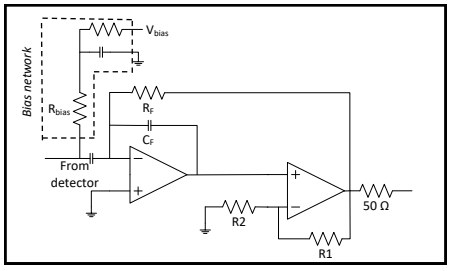
Due to the low power consumption, the preamplifier can operate also in a vacuum chamber without the use of cooling systems.

CAEN offers charge sensitive preamplifiers (Mod. **A1422**) based on A1422H modules and packaged in a 1/4/8 channels boxes. **A1422** are implemented into alloy boxes and feature SHV connectors for the Input/Detector and HV Bias signals, LEMO connectors for the test input and Output/Energy and a cable with a D-type 9 pin male connector for the power supply.

- **Single in-line package hybrid**
- **(38 mm x 23 mm x 3 mm);**
- **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**
- **Up to 200 V (positive or negative) detector bias voltage**
- **Low noise input stage composed JFETs diode protected**
- **Operates in vacuum**

(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



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)

	Detector capacitance	
Model	**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)

	Detector capacitance	
Model	**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

Power requirements

+12 V ⇒ F2: 14 mA F3: 24 mA
- 12 V ⇒ F2: 6 mA F3: 6 mA

Output Linear Range

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

Integral non Linearity

<± 0.05% (0 ÷ ±8 V 1 kΩ termination)

Temperature Instability

< ±100 ppm/°C (0 to 50°C)

Open Loop Gain

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

E^2CRP Maximum energy-squared count-rate product

Sensitivity	**E^2CRP**
5 mV/MeV (Si)	$3.02\ 10^8$ MeV²/s
45 mV/MeV (Si)	$1.11\ 10^8$ MeV²/s
90 mV/MeV (Si)	$1.68\ 10^7$ MeV²/s
400 mV/MeV (Si)	$3.41\ 10^6$ MeV²/s

Decay Time

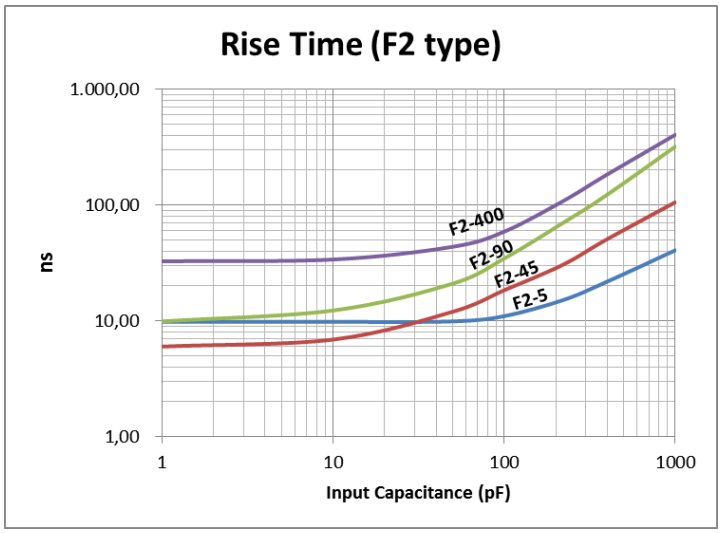
5 mV/MeV (Si)	270 µs
45 mV/MeV (Si)	110 µs
90 mV/MeV (Si)	150 µs
400 mV/MeV (Si)	14 µs

Detector Bias Voltage

±200 V max

Packaging

Single in-line package hybrid
(38 mm x 23 mm x 3 mm);
pin pitch: 2.54 mm; weight: 2.63 g



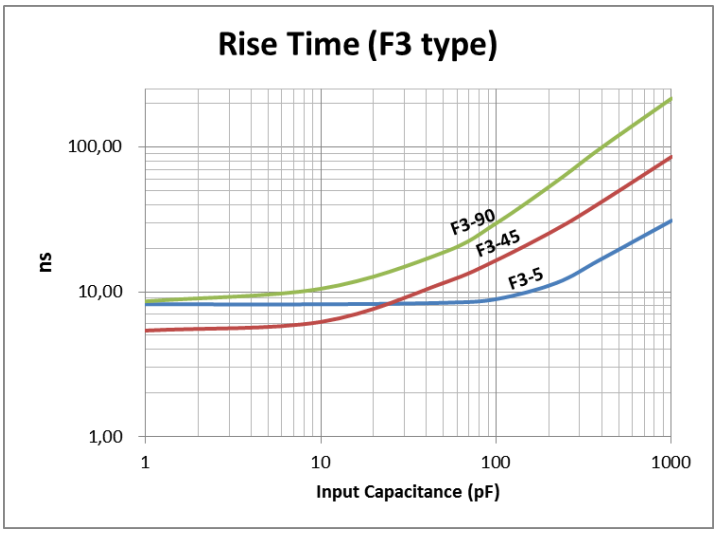
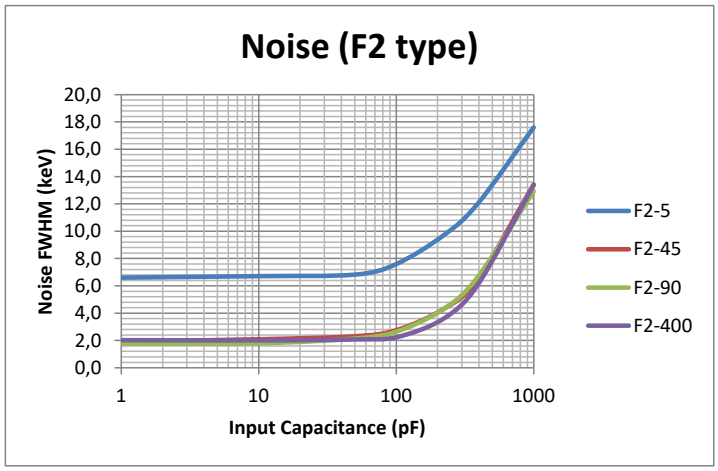


Fig. 1 : Typical Rise Time vs input Capacitance (test input rise time = 1.6 ns, amplitude: 200 mV, 50 Ω termination)



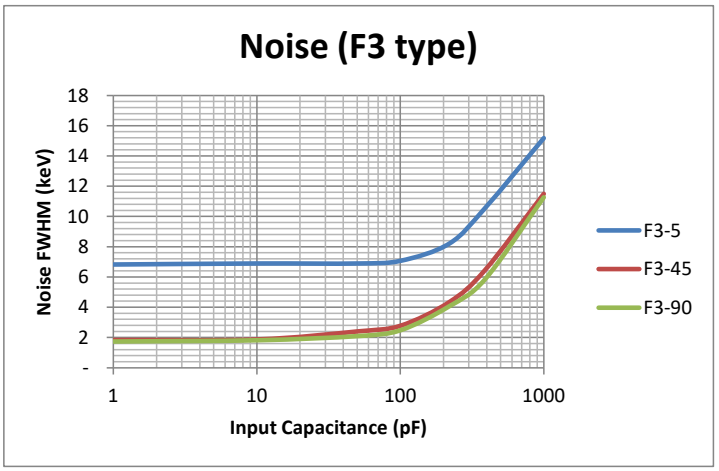
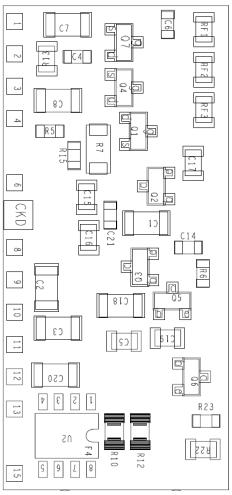


Fig. 2: Maximum Noise vs input Capacitance

Hybrid pin out

Pin 1	Input/Detector
Pin 2	GND
Pin 3	Test input - 1pF or 10 pF (5 mV/MeV)
Pin 4	GND
Pin 5	*Not Mounted*
Pin 6	High Voltage Bias
Pin 7	*Not Mounted*
Pin 8	GND
Pin 9	+12V Power Supply
Pin 10	GND
Pin 11	GND
Pin 12	-12V Power Supply
Pin 13	GND
Pin 14	*Not Mounted*
Pin 15	Output/Energy



Inputs

Input/Detector

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

High Voltage Bias

Up to 200V (positive or negative) for the detector bias. 100 MΩ resistance in series (other on request).

Test

Positive or negative inputs for the energy calibration via Ctest = 1 pF or 10 pF (on 5 mV/MeV versions).

Outputs

Output/Energy

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

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

Ordering Option

Gain mV/MeV	Ordering code	Description
5	WA1422H005F2	A1422H005F2 - Hybrid Charge Preamplifier, 5mV/MeV gain, Cdet<200pF
45	WA1422H045F2	A1422H045F2 - Hybrid Charge Preamplifier, 45mV/MeV gain, Cdet<200pF
90	WA1422H090F2	A1422H090F2 - Hybrid Charge Preamplifier, 90mV/MeV gain, Cdet<200pF
400	WA1422H400F2	A1422H400F2 - Hybrid Charge Preamplifier, 400mV/MeV gain, Cdet<200pF
5	WA1422H005F3	A1422H005F3 - Hybrid Charge Preamplifier, 5mV/MeV gain, Cdet<1000pF
45	WA1422H045F3	A1422H045F3 - Hybrid Charge Preamplifier, 45mV/MeV gain, Cdet<1000pF
90	WA1422H090F3	A1422H090F3 - Hybrid Charge Preamplifier, 90mV/MeV gain, Cdet<1000pF

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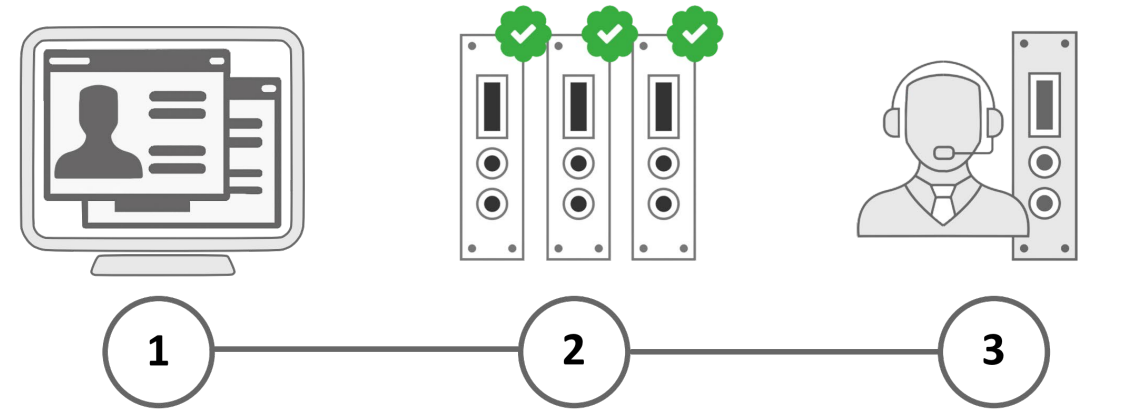

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