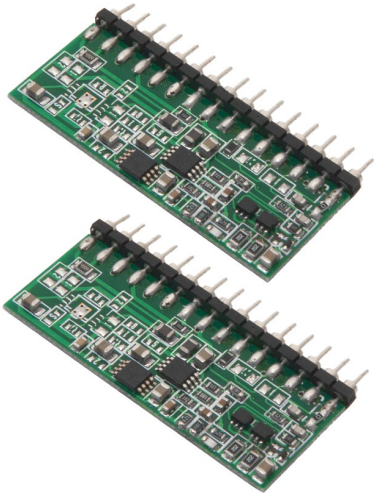
A1422H

Low-Noise Fast-Rise-Time Charge-Sensitive Preamplifiers

Data Sheet



The **A1422H** series is a family of charge-sensitive preamplifiers in a single-in-line-package (SIP) format. Various sensitivity values are available, and a wide range of detector capacitances is supported:

- **F2 type:** up to 200 pF
  ⇒ sensitivities: **5, 45, 90, 400, 450 mV/MeV (Si)**
- **F3 type:** up to 1000 pF
  ⇒ sensitivities: **1**, **5, 45, 90 mV/MeV (Si)**

All models can be used in nuclear and sub-nuclear 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 with a ±4.5 V range into a 50 Ω termination (±10 V into 1 kΩ). A test input pin is also provided, accepting positive and negative signals for calibration.

CAEN also offers charge-sensitive preamplifiers based on A1422H modules (Mod. *A1422*), available in 1-, 4-, and 8-channel boxes. The **A1422** modules are housed in alloy boxes and feature SHV connectors for the Input/Detector and HV bias signals, LEMO connectors for the test input and Output/Energy signals, and a cable terminated with a 9-pin D-sub male connector for the power supply.

- **Single in-line package**
- **(39 mm x 20 mm x 3 mm)**
- **Fast, low-noise inverting preamplifier**
- **Positive or negative input signals**
- **Six available sensitivities:**
  - **1 mV/MeV (Si)**
  - **5 mV/MeV (Si)**
  - **45 mV/MeV (Si)**
  - **90 mV/MeV (Si)**
  - **400 mV/MeV (Si)**
  - **450 mV/MeV (Si)**
- **Up to 1000 pF detector capacitance supported**
- **Up to 800 V (positive or negative) detector bias voltage**
- **Low-noise input stage with diode-protected JFETs**

Specification

Charge Sensitivity (on HiZ)

1 mV/MeV (Si) (only F3)
5, 45, 90 mV/MeV (Si)
400, 450 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	< 4.7	< 7.6
F2 - 45 mV/MeV	< 2.2	< 4.3
F2 - 90 mV/MeV	< 2.2	< 4.2
F2 - 400, 450 mV/MeV	< 2.2	< 4.1
Model	**390 pF**	**1000 pF**
F3 - 1 mV/MeV	< 36.0	< 46.6
F3 - 5 mV/MeV	< 10.5	< 21.5
F3 - 45 mV/MeV	< 5.8	< 13.2
F3 - 90 mV/MeV	< 5.5	< 13.2

Rise Time (2)

	Detector capacitance	
Model	**0 pF**	**200 pF**
F2 - 5 mV/MeV	< 5 ns	< 15 ns
F2 - 45 mV/MeV	< 5 ns	< 15 ns
F2 - 90 mV/MeV	< 10 ns	< 25 ns
F2 - 400, 450 mV/MeV	< 70 ns	< 110 ns
Model	**390 pF**	**1000 pF**
F3 - 1 mV/MeV	< 10 ns	< 20 ns
F3 - 5 mV/MeV	< 20 ns	< 40 ns
F3 - 45 mV/MeV	< 25 ns	< 50 ns
F3 - 90 mV/MeV	< 45 ns	< 100 ns

Power Requirements

1, 5, 45, 90 mV/MeV

+12 V ⇒ F2: 12 mA F3: 20 mA
- 12 V ⇒ F2: 4 mA F3: 4 mA

400, 450 mV/MeV

+12 V ⇒ F2: 16 mA
- 12 V ⇒ F2: 8 mA

Output Linear Range

±10 V 1 kΩ termination
±4.5 V 50 Ω termination

Integral Non-Linearity

<±0.05% (0 to ±10 V, 1 kΩ termination)

Temperature Instability

< ±100 ppm/°C (0 to 50 °C)

Open-loop Gain

1 mV/MeV (F3)	$> 4 \cdot 10^4$
5 mV/MeV (F2 / F3)	$> 1 \cdot 10^5$
45, 90 mV/MeV (F2 / F3)	$> 1 \cdot 10^6$
400, 450 mV/MeV (F2)	$> 1 \cdot 10^6$

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

Sensitivity	E^2CRP
1 mV/MeV (Si)	$7.5 \cdot 10^{11}$ MeV^2/s
5 mV/MeV (Si)	$1.57 \cdot 10^{10}$ MeV^2/s
45 mV/MeV (Si)	$1.57 \cdot 10^{8}$ MeV^2/s
90 mV/MeV (Si)	$7.86 \cdot 10^{7}$ MeV^2/s
400, 450 mV/MeV (Si)	$7.00 \cdot 10^{6}$ MeV^2/s

Decay Time

1 mV/MeV (Si)	47 µs
5 mV/MeV (Si)	100 µs
45 mV/MeV (Si)	100 µs
90 mV/MeV (Si)	50 µs
400, 450 mV/MeV (Si)	27 µs

Detector Bias Voltage

±800 V max

Packaging

Single in-line package
39 mm × 20 mm × 3 mm (pins included)
pin pitch: 2.54 mm; weight: 2.40 g

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

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

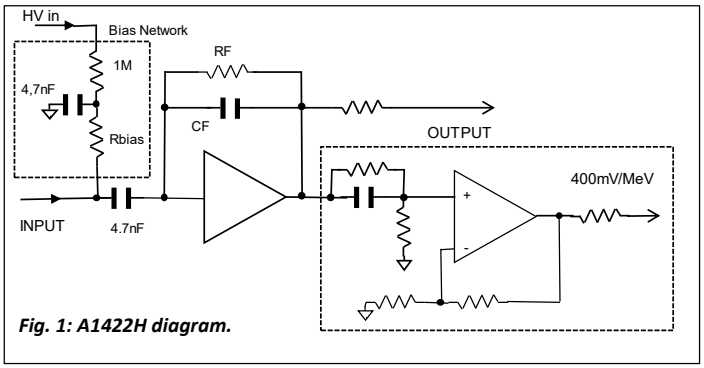
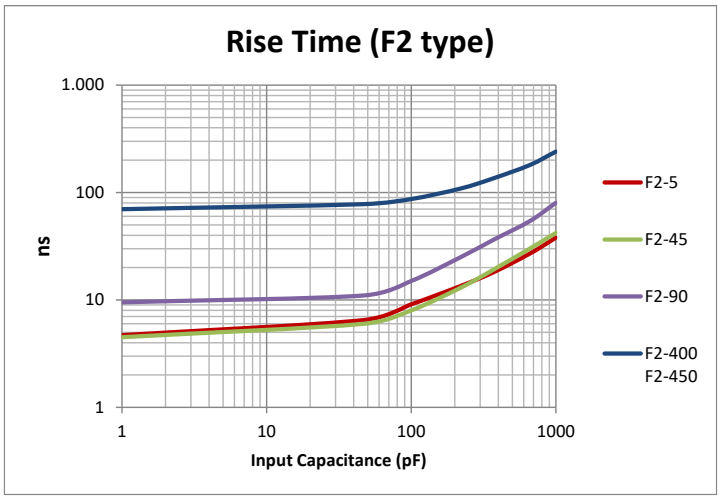


Fig. 1: A1422H diagram.



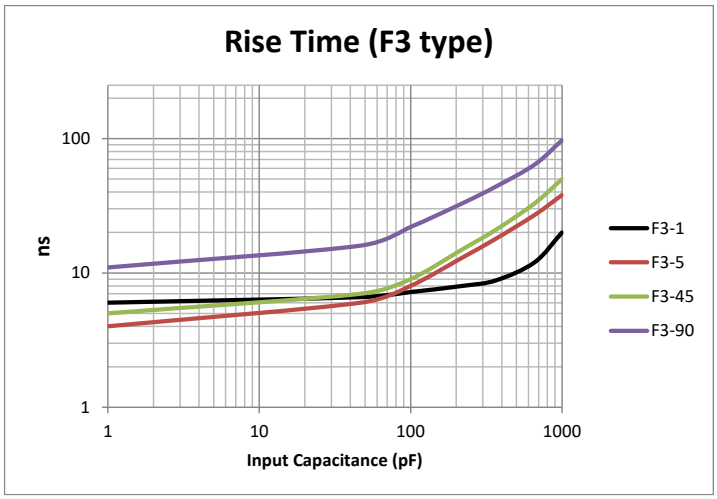
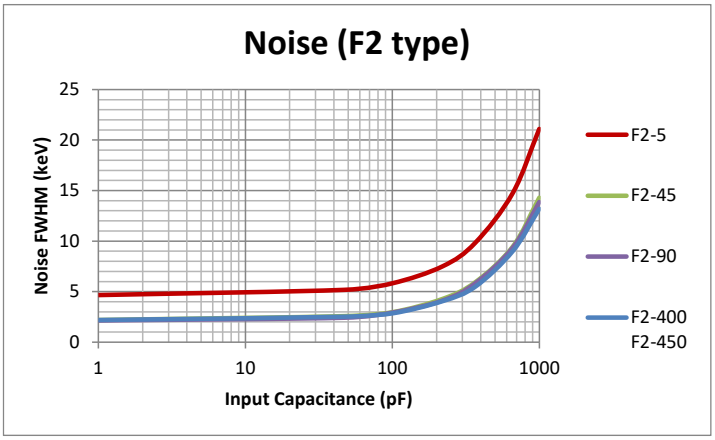


Fig. 2: Typical rise time vs. input capacitance (test input rise time = 1.6 ns; amplitude: 200 mV into 50 Ω termination)



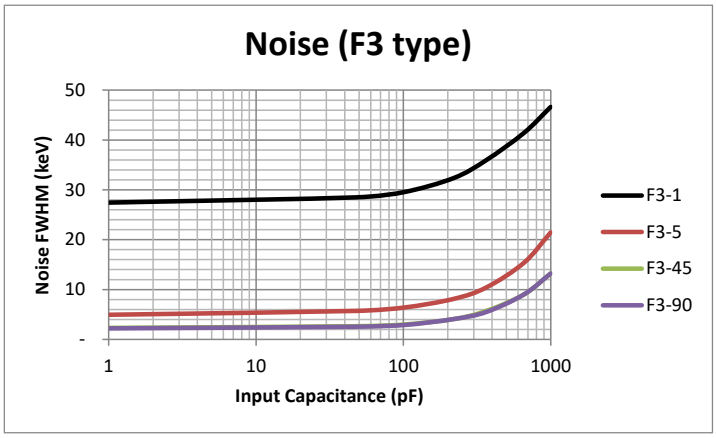
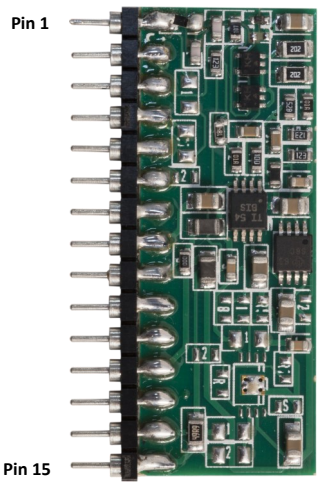


Fig. 3: Maximum noise vs. input capacitance.

Module pinout

Pin 1	Input/Detector
Pin 2	GND
Pin 3	Test input
Pin 4	GND
Pin 5	NC
Pin 6	High-Voltage Bias
Pin 7	NC
Pin 8	GND
Pin 9	+12V Power Supply (± 1%)
Pin 10	GND
Pin 11	GND
Pin 12	-12V Power Supply (± 1%)
Pin 13	GND
Pin 14	NC
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.

High-Voltage Bias

Up to 800 V (positive or negative) for the detector bias.
10 MΩ series resistance (other values available on request).

Test

Positive or negative input for energy calibration through a Ctest capacitor: **1 pF** (standard), **10 pF** on 5 mV/MeV version, and **47 pF** on 1 mV/MeV version.

Outputs

Output/Energy

±10 V max. (open circuit), 50 Ω back-termination. The output voltage is proportional to the input charge.

The typical rise time is

Detector capacitance = 0 pF

< 5 ns F2 - 5, 45 mV/MeV
< 10 ns F2 - 90 mV/MeV
< 70 ns F2 - 400, 450 mV/MeV

Detector capacitance = 390 pF

< 10 ns F3 - 1 mV/MeV
< 20 ns F3 - 5 mV/MeV
< 25 ns F3 - 45 mV/MeV
< 45 ns F3 - 90 mV/MeV

Ordering Options

Gain mV/MeV	Ordering code	Description
1	WA1422H001F3	A1422H001F3 - Charge Preamplifier Module, 1mV/MeV gain, Cdet<1000pF
5	WA1422H005F2	A1422H005F2 - Charge Preamplifier Module, 5mV/MeV gain, Cdet<200pF
45	WA1422H045F2	A1422H045F2 - Charge Preamplifier Module, 45mV/MeV gain, Cdet<200pF
90	WA1422H090F2	A1422H090F2 - Charge Preamplifier Module, 90mV/MeV gain, Cdet<200pF
400	WA1422H400F2	A1422H400F2 - Charge Preamplifier Module, 400mV/MeV gain, Cdet<200pF
450	WA1422H450F2	A1422H450F2 - Charge Preamplifier Module, 450mV/MeV gain, Cdet<200pF
5	WA1422H005F3	A1422H005F3 - Charge Preamplifier Module, 5mV/MeV gain, Cdet<1000pF
45	WA1422H045F3	A1422H045F3 - Charge Preamplifier Module, 45mV/MeV gain, Cdet<1000pF
90	WA1422H090F3	A1422H090F3 - Charge Preamplifier Module, 90mV/MeV gain, Cdet<1000pF

CAEN
Tools for Discovery

CAEN SpA
Via Vetraia 11
55049 – Viareggio Italy
Tel +39.0584.388.398
Fax +39.0584.388.959
info@caen.it www.caen.it

www.caen.it