

# Neutron detector

# CFUM21

## Out-core fission chamber

### Application

- ✓ Detection of thermal neutrons in a flux range of 100 to  $10^{12}$  n.cm<sup>-2</sup>.s<sup>-1</sup>

### Feature

- ✓ High safety of use
- ✓ Integral HN connector

Nuclear characteristics at 20°C			
Sensitivity to thermal neutrons <sup>1</sup> :	Pulse mode	10 <sup>-2</sup>	c.s <sup>-1</sup> /n.cm <sup>-2</sup> .s <sup>-1</sup>
	Fluctuation mode	4x10 <sup>-28</sup>	A <sup>2</sup> .Hz <sup>-1</sup> /n.cm <sup>-2</sup> .s <sup>-1</sup>
	Current mode	10 <sup>-15</sup>	A/n.cm <sup>-2</sup> .s <sup>-1</sup>
Neutron flux range :	Pulse mode <sup>2</sup>	10 <sup>2</sup> - 10 <sup>9</sup>	n.cm <sup>-2</sup> .s <sup>-1</sup>
	Fluctuation mode <sup>3</sup>	10 <sup>6</sup> - 3x10 <sup>11</sup>	n.cm <sup>-2</sup> .s <sup>-1</sup>
	Current mode <sup>4</sup>	10 <sup>8</sup> - 10 <sup>12</sup>	n.cm <sup>-2</sup> .s <sup>-1</sup>
Gamma sensitivity:		10 <sup>-9</sup>	A/Gy.h <sup>-1</sup>
Exposure limits:	Thermal neutrons <sup>5</sup>	max 2x10 <sup>19</sup>	n.cm <sup>-2</sup>
Gamma radiation:	Exposure	max 10 <sup>9</sup>	Gy
	Dose rate	max 10 <sup>4</sup>	Gy.h <sup>-1</sup>

### Electrical characteristics

Insulating resistance at 600V <sup>6</sup> :	min 10 <sup>12</sup>	Ω
Charge collection time <sup>7</sup> :	50	ns
Detector: Capacitance	70	pF
Cable: Capacitance Capacitance impedance Attenuation	170	pF/m
	50	Ω
	0.34	dB/m

### Mechanical and physical characteristics

Detector: Materials:	Case, electrodes Insulator Brazing	Aluminium Al <sub>2</sub> O <sub>3</sub> AgCu
Sensitive layer:	Uranium enriched in <sup>235</sup> U Mass	>90% 0.07 mg.cm <sup>-2</sup>
Filling gas <sup>8</sup> (pressure)		Argon + 4% nitrogen (at 400 kPa)
Dimensions: Nominal diameter Detector length Sensitive length		25.4 mm
		227 mm
		120 mm
Connector: Type <sup>9</sup>		Watertight, HN Female
Insulator		Al <sub>2</sub> O <sub>3</sub>

### Notes.

*Unless otherwise stated, all characteristics are given at 20°C*

<sup>1</sup> Values depending on the characteristics and the calibration of the measurement equipment. The pulse sensitivity is calculated from the (α-neutron) discrimination curve for a discriminating threshold corresponding to a counting rate of 0.01 c.s<sup>-1</sup>.

<sup>2</sup> Pulse mode operating range for a measurement equipment with a resolution shorter than the collection time of the detector.

<sup>3</sup> Fluctuation operating range measured on an equipment with a 1 to 30 kHz band pass.

<sup>4</sup> Current mode operating range: the lower limit of the current mode operating range depends on the electronics (especially on the input amplifier) and on the signal / parasitic current ratio (parasitic current = leakage current + gamma current + α-current). The upper limit is depending both on the detector and electronics (loss of linearity).

<sup>5</sup> Flux corresponding to a 1 % sensitivity loss of the detector.

<sup>6</sup> For sensible fission chambers (s > 0.1 c.s<sup>-1</sup>/n.cm<sup>-2</sup>.s<sup>-1</sup>), the α-current is predominant in relation to the leakage current from the insulators. The insulating resistance is then measured by the ratio ΔU/ΔI of the I=f(U) curve determined without any ionizing radiation.

<sup>7</sup> Charge collection time: the measured value depends on the electronics and on the cable capacitance.

<sup>8</sup> The use of a gas mixture (Ar + N<sub>2</sub>) increases the electron velocity and therefore favours a short collection time.

<sup>9</sup> In order to avoid humidity penetration during storage, the connector is closed with a cap to be removed just before use. As a general rule, prevent any humidity penetration at the connection level (refer to "Instructions for use and handling" in the package). Other connector types are possible. To be required when ordering.

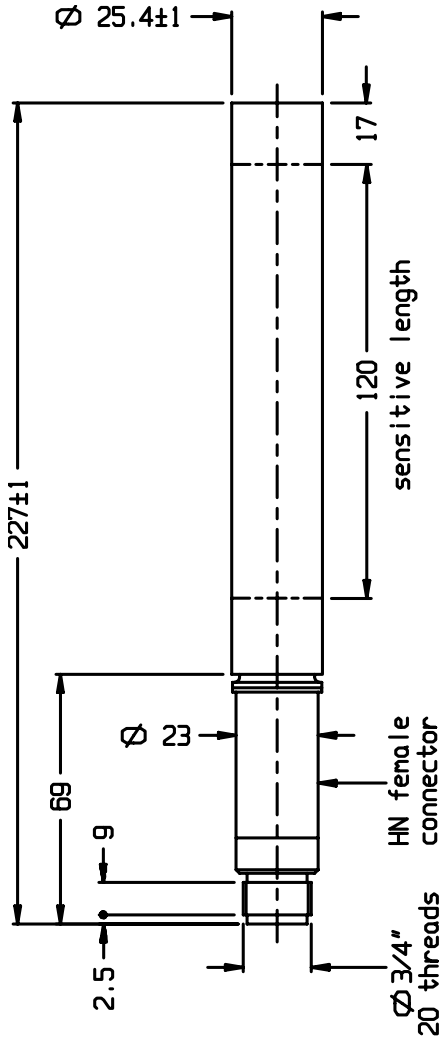
<sup>10</sup> Including temperature increase due to gamma radiation (effective above 10<sup>4</sup> Gy.h<sup>-1</sup>). The maximum operating temperature is indicated for pulse operating mode. The leakage current in the cables increases rapidly with temperature. It is therefore necessary to take into account this characteristic, which limits the maximum temperature so that the ratio of wanted signal/parasitic signal remains acceptable.

<sup>11</sup> Vibration test conditions: frequency 60 Hz, amplitude ± 1.5 mm.

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Outline (dimensions in mm)



Limiting values	Max
Operating temperature <sup>10</sup>	250 °C
Vibration (any axis) <sup>11</sup>	200 m.s <sup>-2</sup>
Shock (perpendicular axis)	500 m.s <sup>-2</sup>