

Neutron detector

CFUL08

Out-core fission chamber with integral cable

Application

- ✓ Detection of thermal neutrons in a flux range of 1 to 10^{10} n.cm⁻².s⁻¹

Features

- ✓ High sensitivity
- ✓ Very high safety of use

Nuclear characteristics at 20°C			
Sensitivity to thermal neutrons ¹ :	Pulse mode	1	c.s ⁻¹ /n.cm ⁻² .s ⁻¹
	Fluctuation mode	4x10 ⁻²⁶	A ² .Hz ⁻¹ /n.cm ⁻² .s ⁻¹
	Current mode	2x10 ⁻¹³	A/n.cm ⁻² .s ⁻¹
Neutron flux range :	Pulse mode ²	1 - 10 ⁶	n.cm ⁻² .s ⁻¹
	Fluctuation mode ³	8x10 ⁴ - 2x10 ⁹	n.cm ⁻² .s ⁻¹
	Current mode ⁴	10 ⁴ - 10 ¹⁰	n.cm ⁻² .s ⁻¹
Gamma sensitivity:		7x10 ⁻⁹	A/Gy.h ⁻¹
Exposure limits:	Thermal neutrons ⁵	max 2x10 ¹⁹	n.cm ⁻²
Gamma radiation:	Exposure	max 10 ⁹	Gy
	Dose rate	max 10 ⁴	Gy.h ⁻¹

Electrical characteristics			
Insulating resistance at 600V ⁶ :	Nominal at 20°C	min 10 ¹²	Ω
	Detector + 9m cable at 250°C	min 5x10 ⁸	Ω
Operating voltage:	Nominal up to 250°C	600	V
	Maximum at 20°C	800	V
	Limit with no radiation	1300	V
Charge collection time ⁷ :		80	ns
Detector:	Capacitance	240	pF
Cable:	Capacitance	170	pF
	Characteristics impedance	50	Ω
	Attenuation	0.34	dB/m

Mechanical and physical characteristics			
Detector:	Materials:	Case, electrodes Insulator Brazing	Aluminium Al ₂ O ₃ AgCu
	Sensitive layer:	Uranium enriched in ²³⁵ U Mass	>90% 1.32 mg.cm ⁻²
Filling gas ⁸ (pressure)			Argon + 4% nitrogen (at 250 kPa)
Dimensions:	Nominal diameter	48	mm
	Detector length	345.5	mm
	Overall length, on request ⁹	max 12	m
	Sensitive length	211	mm
Cable:	Type ¹⁰ : high immunity, mineral insulator	6 coax	
	External diameter	6	mm
	Insulator Curvature radius ¹¹	MgO min 60	mm
Connector:	Type ¹² CFUL08/F ⁹ CFUL08/M ⁹ Insulator		Watertight, HN Female Male Al ₂ O ₃

Notes.

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

¹ 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 1 c.s⁻¹.

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

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

⁴ 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).

⁵ Flux corresponding to a 1 % sensitivity loss of the detector.

⁶ For sensible fission chambers (s > 0.1 c.s⁻¹/n.cm⁻².s⁻¹), 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.

⁷ Charge collection time: the measured value depends on the electronics and on the cable capacitance.

⁸ The use of a gas mixture (Ar + N₂) increases the electron velocity and therefore favours a short collection time.

⁹ The type of connector (male or female) as well as the overall length (detector+cable+connector) constitute the version code to be mentioned in the detector reference after the basic type number. For example CFUL08/F5 indicates a detector with a female connector and a 5 m overall length.

¹⁰ Our "6 coax" cable is the 1 Zs FCAc 60 referenced cable from Thermocoax.

¹¹ This is the smallest curvature radius allowing one reversible deformation.

¹² 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 on special request.

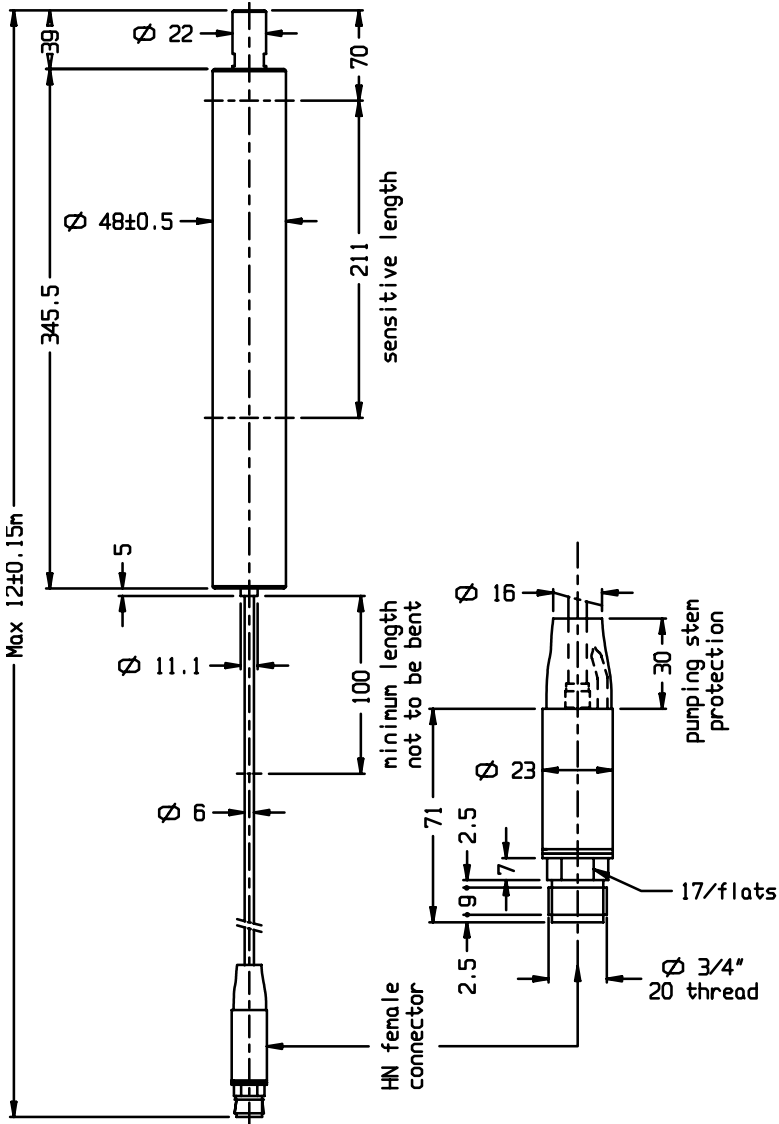
¹³ Including temperature increase due to gamma radiation (effective above 10⁴ Gy.h⁻¹). The maximum operating temperature is indicated for pulse operating mode. The leakage current in the cable increases rapidly with temperature. It is therefore necessary to take into account this characteristic, which limits the maximum temperature so that the ratio of wanted signal/parasitic signal remains acceptable.

¹⁴ Vibration test conditions: frequency 60 Hz, amplitude ± 1.5 mm.

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Outline (dimensions in mm)



Limiting values	Max
Operating temperature ¹³	250 °C
Vibration (any axis) ¹⁴	200 m.s ⁻²
Shock (perpendicular axis)	500 m.s ⁻²