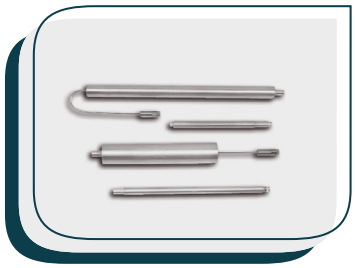
ASSURE
YOUR SAFETY

PHOTONIS
EXOSENS GROUP

Nuclear Instrumentation

BORON LINED PROPORTIONAL COUNTERS

Thermal neutron detectors / Operating in pulse mode. Watertight HN connectors ensure a high safety of use.



APPLICATIONS

- Monitoring nuclear reactors in the source range
- Fuel reprocessing operations
- Special equipment in reactors (boron-meters)

OPTIONS

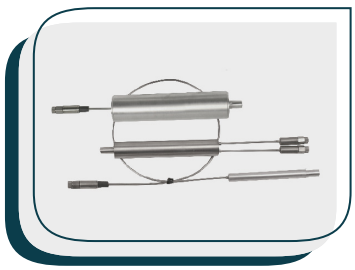
- Integral HN connector
- Integral mineral insulated cable

Type	Neutron Sensitivity (cps/nv)	Neutron Flux Range (nv)	ø (mm)	Sensor Length (mm)	Integral Cable (mm)	Max Operating T° (°C)
CPNB28	5	$2 \times 10^{-1} – 4 \times 10^{5}$	25.4	368	No	200*
CPNB48	10	$1 \times 10^{-1} – 2 \times 10^{5}$	25.4	60	No	200*
CPNB44	8	$1 \times 10^{-1} – 2 \times 10^{5}$	48	761	6	200*
CPNB65	25	$5 \times 10^{-2} – 5 \times 10^{4}$	76.5	727	No	200*
CPNB64	25	$5 \times 10^{-2} – 5 \times 10^{4}$	76.5	741.5	6	200*
CPNB84	42	$5 \times 10^{-2} – 3 \times 10^{4}$	82	741.5	6	200*

** This temperature depends on the material used to make the connection tight (inside the mating connector).*
nv: thermal neutron flux in $cm^{-2}\ s^{-1}$. cps: counts per second.

FISSION CHAMBERS FOR OUT-OF-CORE

Severe environmental conditions. Watertight HN connectors ensure a high safety of use.



APPLICATIONS

- Thermal neutron detection
- Wide range reactor monitoring
- Waste monitoring

OPTIONS

- Integral HN connector
- Integral mineral insulated cable
- Complete Inconel protection

Type	Neutron Sensitivity (cps/nv)		Neutron Flux Range (nv)		ø (mm)	Sensor Length (mm)	Integral Cable (mm)	Max Operating T° (°C)
	Pulse Mode (cps/nv)	Current Mode (A/nv)	Pulse Mode	Current Mode				
CFUM11	1×10^{-1}	1×10^{-14}	$10 - 10^{7}$	$10^{7} - 10^{11}$	25.4	227	No	250*
CFUM18	1×10^{-1}	1×10^{-14}	$10 - 10^{7}$	$10^{7} - 10^{11}$	25.4	263	6	250
CFUM21	1×10^{-2}	1×10^{-15}	$10^{2} - 10^{8}$	$10^{8} - 10^{12}$	25.4	227	No	250*
CFUM19	0.6	1.2×10^{-13}	$2 - 2 \times 10^{6}$	$2 \times 10^{4} - 2 \times 10^{10}$	48	421	6 + 6	250
CFUP08	0.7	1.4×10^{-13}	$1 - 10^{6}$	$10^{4} - 10^{10}$	76.5	389	6 + 6	250
CFUC06	1	2×10^{-13}	$1 - 10^{5}$	$10^{4} - 10^{10}$	48	412	6 + 6	600
CFUL01	1	2×10^{-13}	$1 - 10^{6}$	$10^{4} - 10^{10}$	48	337	No	250
CFUL08	1	2×10^{-13}	$1 - 10^{6}$	$10^{4} - 10^{10}$	48	384.5	6	250
CFUK09	3	6×10^{-13}	$0.3 - 3 \times 10^{5}$	$10^{5} - 10^{10}$	60	385	No	250*
CFUG08	4	8×10^{-13}	$0.2 - 2 \times 10^{5}$	$10^{5} - 7 \times 10^{10}$	80	419	6	250

** This temperature depends on the material used to make the connection tight (inside the mating connector).*
nv: thermal neutron flux in $cm^{-2}\ s^{-1}$. cps: counts per second.

CABLE EXTENSIONS

- High-immunity mineral insulated extension cables
- Transmission of low level impulsion signals
- Under harsh environmental conditions
- Pulse or current transmission up to 20 bars external pressure

OPTIONS

- BNC connectors
- High resistance to radiations and electromagnetic parasitic signals
- Cable insulator MgO, SiO_2 or Al_2O_3

Type	Mode	Cable		Connector		Characteristic Impedance
		ø (mm)	Insulator	Type	Insulator	Ω
EXT-BNC	Current	3	Al_2O_3	BNC	PTFE	-
EXT-HN	Pulse	6	MgO	HN	Al_2O_3	50

FISSION CHAMBERS FOR IN-CORE USE

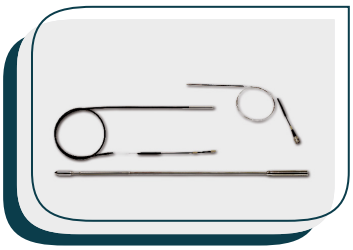
Under severe environmental conditions: high T° - humidity - gamma flux

APPLICATIONS

- Detection of thermal neutrons in high flux
- Monitoring of the reactor fuel burn up
- Start-up, intermediate and power range
- Flux map measurement

OPTIONS

- Integral HN connector
- Integral mineral insulated cable
- Movable versions with propulsion cable



Type	Neutron Sensitivity (cps/nv)		Neutron Flux Range (nv)		ø (mm)	Sensor Length (mm)	Integral Cable (mm)	Max Operating T° (°C)
	Pulse Mode (cps/nv)	Current Mode (A/nv)	Pulse Mode	Current Mode				
CFUE24	1×10^{-2}	1×10^{-15}	$10^2 – 10^8$	$10^8 – 10^{12}$	7	150	6	400
CFUE32	1×10^{-3}	1×10^{-16}	$10^3 – 10^8$	$10^9 – 10^{13}$	7	150	6	600
CFUF43	-	1×10^{-17}	-	$10^{10} – 10^{14}$	4.7	86	1	350
CFUR43	-	3×10^{-18}	-	$10^{11} – 1.5 \times 10^{14}$	3	42	1	350
CFUZ53	-	5×10^{-18}	-	$2 \times 10^{11} – 10^{14}$	1.5	49	1	350
CFUR64	8×10^{-6}	9.2×10^{-19}	$10^6 – 10^{11}$	$10^{12} – 10^{15}$	3	42	2.2	400

nv: thermal neutron flux in cm^{-2} s^{-1}. cps: counts per second.

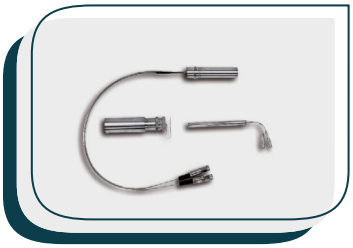
GAMMA IONISATION CHAMBERS

MEASUREMENT OF GAMMA RADIATIONS

- In nuclear power plants
- In uranium reprocessing plants
- From ^{60}Co sources

OPTIONS

- Guard ring structure (very low leakage current)
- Compensation of energy spectrum by metallic filters



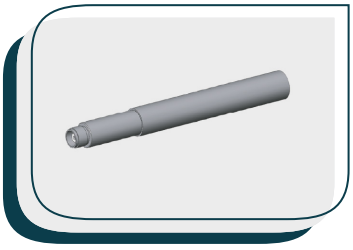
Gas characteristics adapted to requirements.

Type	Gamma Sensitivity (A/Gy h^{-1} ^{60}Co)	Gamma Flux Range (Gy/h)	ø (mm)	Sensor Length (mm)	Integral Cable (mm)	Max Operating T° (°C)
CRGJ16	5×10^{-8}	$10^{-5} – 50$	42.5	189	4+4	250
CRGB10/Xe	7.2×10^{-8}	$10^{-5} – 2 \times 10^2$	48	137	No	250*
CRGB10/N_2	6×10^{-10}	$10^{-3} – 10^5$	48	137	No	250*
CRGA11	1.5×10^{-10}	$3 \times 10^{-3} – 10^3$	18	234	3+3	350
CRGE10/Xe	4.5×10^{-11}	$10^{-1} – 10^6$	7	85.5	3	400
CRGE10/N_2	4.8×10^{-13}	$10 – 10^8$	7	85.5	3	400

** This temperature depends on the material used to make the connection tight (inside the mating connector).*

DEVELOPMENTS AND CUSTOMISATION

- Adapt versions of industrialised product to customer specific requirements
- Develop new detectors with our dedicated R&D team
- Theoretical approach, modeling, qualification test
- Collaboration with the CEA
- Full control of the complete manufacturing process on site
- Support from all of the Photonis Group activities - experience and knowledge



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