ASSURE
YOUR SAFETY

PHOTONIS
Reveal the invisible

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 equipments in reactors (boron-meters)

OPTIONS

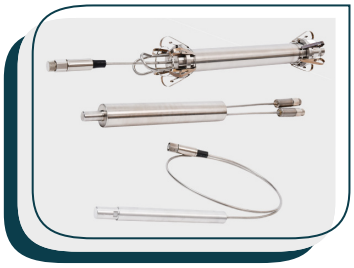
- Integral HN connector
- Integral mineral insulated cable

Type	Neutronsensitivity (cps/nv)	Neutron flux range (nv)	ø (mm)	Sensor length (mm)	Integral cable (mm)	Max operating T° (°C)
CPNB28	5	$2x10^{-1} – 4x10^{5}$	25.4	368	No	200 *
CPNB48	10	$1x10^{-1} – 2x10^{5}$	25.4	560	No	200 *
CPNB44	8	$1x10^{-1} – 2x10^{5}$	48	761	6	200
CPNB65	25	$5x10^{-2} – 5x10^{4}$	76.5	727	No	200 *
CPNB64	25	$5x10^{-2} – 5x10^{4}$	76.5	741.5	6	200
CPNB84	42	$5x10^{-2} – 3x10^{4}$	82	741.5	6	200

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

FISSION CHAMBERS FOR EX-CORE USE

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	Neutronsensitivity		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 *
CFUC19	0.6	$1.2x10^{-13}$	$2 – 2x10^{6}$	$2x10^{4} – 2x10^{10}$	48	421	6+6	250
CFUP08	0.7	$1.4x10^{-13}$	$1 – 10^{6}$	$10^{4} – 10^{10}$	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}	$0.3 – 3x10^{5}$	$10^{5} – 10^{10}$	60	385	No	250 *
CFUG08	4	8×10^{-13}	$0.2 – 2x10^{5}$	$10^{5} – 7x10^{10}$	80	419	6	250

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

CABLE EXTENSIONS

- High-immunity mineral insulated extension cables
- Transmission of low level impulsional signals
- Under hard 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 $Al2O^3$

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

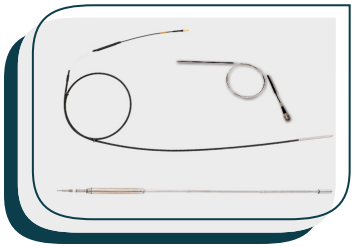
Under severe environmental conditions: high T° - humidity - gamma flux

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	Neutronsensitivity		Neutron flux range (nv)		ø (mm)	Sensor length (mm)	Integral cable (mm)	Max operating T° Ω
	Pulse mode (cps/nv)	Current mode (A/nv)	Pulse mode	Current mode				
CFUE24	$1x10^{-2}$	$1x10^{-15}$	$10^2 – 10^8$	$10^8 – 10^{12}$	7	150	6	400
CFUE32	$1x10^{-3}$	$1x10^{-16}$	$10^3 – 10^8$	$10^9 – 10^{13}$	7	150	6	600
CFUF43	-	$1x10^{-17}$	-	$10^{10} – 10^{14}$	4.7	86	1	350
CFUR43	-	$3x10^{-18}$	-	$10^{11} – 1.5x10^{14}$	3	46	1	350
CFUZ53	-	$5x10^{-18}$	-	$2x10^{11} – 10^{14}$	1.5	49	1	350
CFUR64	$8x10^{-6}$	$9.2x10^{-19}$	$10^6 – 10^{11}$	$10^{12} – 10^{15}$	3	42	2.2	400

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

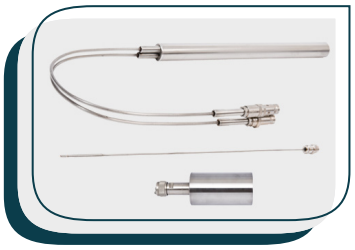
GAMMA IONISATION CHAMBERS

MEASUREMENT OF GAMMA RADIATIONS

- In nuclear power plants
- In uranium reprocessing plants
- From 60Co sources

OPTIONS

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



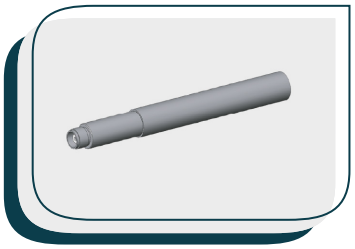
Gas characteristics adapted to requirements.

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	$5x10^{-8}$	$10^{-5} – 50$	42.5	189	4+4	250
CRGB10/Xe	$7.2x10^{-8}$	$10^{-5} – 2x10^2$	48	141	No	250*
CRGB10/N2	$6x10^{-10}$	$10^{-3} – 10^5$	48	141	No	250*
CRGA11	$1.5x10^{-10}$	$3x10^{-3} – 10^3$	18	234	3+3	350
CRGE10/Xe	$4.5x10^{-11}$	$10^{-1} – 10^6$	7	85.5	3	400
CRGE10/N2	$4.8x10^{-13}$	$10 – 10^8$	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



nuclearsales@photonis.com

photonis.com

PHOTONIS
Reveal the invisible