



# Wide Range Neutron Detectors

For more than 60 years, Reuter-Stokes, a Baker Hughes business, has maintained its position as a world leader in neutron detection sensors. Reuter-Stokes' Wide Range Neutron Monitor (WRNM), used in boiling water reactors (BWR), is a fission chamber used to measure neutron flux for both source and intermediate range during startup and shutdown.

## A Single Stationary Sensor

Reuter-Stokes designed its WRNM—also recognized as a start-up range monitor (SRNM)—to perform the functions of both the source range neutron monitor (SRM) and the intermediate range monitor (IRM) during reactor startup and shutdown.

The Reuter-Stokes's WRNM and SRNM detectors operate in a dry tube inside the reactor core and are permanently fixed within the reactor core, even when operating at full power, throughout the entire fuel cycle. The stationary nature of the WRNM eliminates mechanical drive equipment, thereby contributing to lower maintenance costs and hands-off operation.

## Accurate and Reliable Neutron Detection

The Reuter-Stokes WRNM/SRNM measures reactor neutron flux from 10–7 percent (source range) to approximately 20 percent of full power. The WRNM delivers continuous power indication for the entire start-up period, requiring no range selection switches. The WRNM/SRNM counting sensitivity

is rated at  $2.1 \times 10^{-3} \text{ cps/nv} \pm 20\% @ 0 \text{ nvt}$ , one of the most sensitive in the industry.

And since the WRNM/SRNM uses fewer moving parts than the SRM/IRM detectors, Reuter-Stokes' detector contributes to more reliable operation, lower operation and maintenance costs, and reduces radiation dose exposure.

Our Reuter-Stokes WRNM/SRNM has a proven track record of reliable operation in the harsh, in-core environment. Continuous design and engineering upgrades over years of operation now deliver a higher signal-to-noise ratio, extended life and superior reliability compared to the preceding solution.

## A Partner for the Life of Your Plant

Nuclear instrumentation from Reuter-Stokes means more than delivering the industry's leading technology. Recognizing that detector life depends on the actual level of neutron flux, Reuter-Stokes also provides extensive technical services to help maximize the life of the detector based on specific operating conditions of the reactor.

From reactor start-up, to life extensions and power uprates, Reuter-Stokes offers our profound understanding of the operational challenges and demanding environments entailed with every step.

Please contact Reuter--Stokes for further details on the industry's leading suite of neutron monitoring instrumentation.

## Wide Range Neutron Range Monitor RS-C6-04X0-20X

Mechanical (Sensor)	
Diameter	.545"
Lenght	5.83"
Connector	Modified Lemo
Materials (Sensor)	
Outer shell	304L SS
Cathode	Inconel
Anode	Inconel
MI cable sheath	304L SS
Insulation	Alumina/silica
Insulation Resistance	
@25°C	1 x 10 <sup>10</sup> minimum (field environment)
@315°C	1 x 10 <sup>8</sup> minimum
Ground Isolation Resistance	
@25°C	1 x 10 <sup>5</sup> minimum (field environment)
@315°C	2 x 10 <sup>4</sup> minimum
Voltage Breakdown	
<650 VDC @ 0 nvt	
Capacitance	
≤ 27.5 pf/ft	
Maximum Ratings	
Perturbed neutron flux	2.1 x 10 <sup>14</sup> nv
Perturbed neutron fluence	1.24 x 10 <sup>22</sup> nvt
Gamma exposure rate	2.2 x 10 <sup>9</sup> R/hr
Operating Characteristics	
Counting sensitivity @300°C	2.1 x 10 <sup>-3</sup> cps/nv ± 20% @ 0 nvt
MSV sensitivity @300°C	3.8 x 10 <sup>-29</sup> A <sup>2</sup> /Hz/nv ± 20% @ 0 nvt
Nominal operating voltage	≤200 VDC to maintain 8 ma max current