

NUCLEAR POWER PLANT PROCESS MONITOR

核电站工艺监测器

Model FM-9W-IC-25-HT Ion Chamber

FEATURES: 特点

- HIGHLY SENSITIVE GAMMA
对伽马高度灵敏
- MEETS LOCA REQUIREMENTS,
(Loss of Coolant Accident Prevention)
符合 LOCA 要求 (防止冷却剂事故损失发生)
- ALL PLUG-IN MODULAR
全插件式模块
- RACK MOUNTING OR CASE
架装或带外箱
- SINGLE OR MULTI-CHANNEL
单道或多道
- SEALED ION CHAMBER FOR EXCELLENT RADIATION
RESPONSE
密封电离室极佳辐射响应
- LOCAL OR REMOTE MONITORING; USB/ETHERNET
OUTPUT
本地或远程监测, USB/以太网输出
- SMART ELECTRONICS- ON-BOARD
MICROPROCESSOR AND DATA-LOGGING; LCD
COLOR DISPLAY
智能电子学-机载, 微处理和数据录入, LCD 彩屏显示
- USER-SETTABLE ALARMS, UNITS OF MEASUREMENT
用户可设定报警值, 测量单位等
- SAFETY CLASS QUALIFIED FOR NUCLEAR POWER
PLANT
符合核电站安全等级
- DETECTOR: IP67
探测器: IP 67
- ELECTRONICS: IP63
电子学: IP 63



FM-9W ELECTRONICS

电子学部分

APPLICATION: 应用

Area monitoring in and around nuclear reactors, hot cells, irradiators and other facilities handling radioactive materials or x-rays.

对核电站、热室、辐照器及其它处理辐射材料或 X-射线的设施内部/周围进行区域监测



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DESCRIPTION: 说明

- The FM-9W Series Radiation Monitors incorporate micro-processor driven smart electronics with color LCD display.
- FM-9W 系列辐射监测器配备 LCD 彩显智能电子学驱动的微处理器
- On-board data-logging and user-adjustable parameters are featured. The plug-in modular construction, allows the addition of channels or functions.
- 机载数据录入，用户可设定参数，插卡式模块结构，允许通道或功能拓展
- Ion chamber and circuit design prevent the system readings from falling off full scale during an over range condition.
- 电离室和电路设计防止系统读数在过量程情况下偏出读数器
- Both the detector and connecting cable are designed for optimal performance in strenuous conditions, such as in containment buildings.
- 探头和连接线优化设计适合特殊环境，如核岛。
- High level alarm can be set to any value desired. Alarm activation produces red light on front panel and piercing audio tone.
- 上限报警值可任意设定，报警激活时前板上红灯亮且伴随刺耳报警音。
- Optional relay is also closed (or opened) for activation of remote alarms. Stand-by battery power is optional. Rack or case mounting is supplied.
- 继电器也随之关闭（或打开）激活远程报警（选购），可选购备用电池，提供架装或箱装。

GENERAL SPECIFICATIONS: 一般规格:

DETECTOR:

探测器

Detector Type:

High pressurized ion chamber

探测器类型:

高压电离室

Range:

STANDARD: 5 decades

1 μ Gy/h to 0.1 Gy/h (100 μ R/h to 10 R/h)

标准量程: 5 量级

Range:

OPTIONAL: 6 decades

1 μ Gy/h to 1 Gy/h (100 μ R/h to 100 R/h)

可选量程: 6 量级

Dose Rate Range:

100 nSv/h – 1 Sv/h (10 mR/h – 100 R/h)

剂量率量程:

Energy Rejection:

Thermal Neutrons, Alphas, Betas

能量抑制:

热中子, α , β

Energy range:

80 KeV to 7 MeV

能量范围:

Response Time:

0.5 to 3 seconds (slower at lower decade, faster at higher decade)



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响应时间:	0.5-3 秒 (视量级不同)
Environment:	Temperature: 165° C duration of 12 Hours
	Relative Humidity: Up to 95%
	Total Integrated Dose: 2 x 10 ⁶ Gy
环境:	温度: 12 小时 165°C; 湿度: 可达 95%; 总剂量 2 x 10 ⁶ Gy
Accuracy:	<± 10%
精度:	
Temperature Dependence:	<.2% / °C
温度依赖:	
Storage Temperature Range:	-40°C to 85°C
储藏温度:	

ELECTRONICS (LPDU) FM-9W: 电子学 FM-9W

Read Out:	Alpha-Numeric
显示:	数字
Modes (Five):	Alert, High, High-High, Operation, Test
模式 (5):	报警, 高, 高-高, 运行, 测试
• Alarms:	User Settable To Any Trigger Level.
报警:	用户设定报警
Alarms – Beacon Assembly:	Green, Yellow, Red
报警-报警灯:	绿, 黄, 红
	Visual: (High-High) Red Flashing when Radiation Reaches Set Point
	Audio: 90 dB at 1 meter
	高-高报警红灯闪烁; 声音报警一米处 90 分贝
Low Level Alarm:	Automatic reset.
下限报警:	自动重设
High Level Alarm:	High level alarm remains activated until ACKNOWLEDGE & RESET button is pushed.
上限报警:	按下“确认&重设”按钮取消上限报警
Alarm Clearance:	Automatic Reset
报警清除:	自动重设
Visual Alarm:	On-screen alarms and warnings. Red: High level. Amber: Low level
视觉报警:	屏显报警, 红色: 上限; 琥珀色: 下限
Environment:	Temperature: Up to 50° C
环境:	温度



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Relative Humidity: Up to 95%

Total Integrated Dose: 10 Gy

相对湿度: 达 95%, 总剂量 10Gy



Weight & Dimensions:

Size: 12" x 12" x 12"

Weight: 26 lbs

重量&尺寸:

ELECTRONICS (RDU) FM-9W SERIES HUB: 电子学 FM-9W 系列转发器

Display: Color LCD display

显示: 彩色 LCD 显示

Display Read Out: Digital Alpha-Numeric

显示读出: 数字显示

Read Out Units: Gy/h (User Settable)

读出单位: 可用户设定

Modes (Five): Alert, High, High-High, Operation, Test

模式 (5): 报警, 高, 高-高, 运行, 测试

Alarms: Green, Yellow, Red

Warning, Equipment Failure, Over-Range, Detector Status

Audio: 90 dB at 1 meter

Visual: Red Flashing when Radiation Reaches Set Point

报警: 绿, 黄, 红; 警告, 设备故障, 过量程, 探测器状态。

声音报警一米处 90 分贝

视觉报警: 辐射达到设定点时闪烁红灯

Alarm Acknowledgement: Silent Mode Push Button

报警确认: 按下按钮静音

Low Level Alarm: Automatic reset.

下限报警: 自动重设

High Level Alarm: High level alarm remains activated until ACKNOWLEDGE & RESET button is pushed.

上限报警: 按下“确认&重设”按钮消除报警

Alarm Clearance: Automatic Reset

报警清除: 自动重设

Visual Alarm: On-screen alarms and warnings. **Red:** High level. **Amber:** Low level



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视觉报警: 屏显报警, 红色: 上限, 琥珀色: 下限
Output: USB/Ethernet
输出:
Power supply: 120v 60 hz or 230v 50 hz or 24 volt DC, 2 Amp
电源:
Relay output: 230v, 10 Amp
继电器输出:

Outputs: 输出:

Buffered isolated 4-20 mA Logarithmic Analog Output Covering the full range of the monitor.

设备全量程缓冲隔离的 4-20mA 输出

- Stable Within 1% Due to Drift, Temperature, or Line Variations
由于漂移, 温度和线性变换, 稳定在 1%内
- Logic Level Signals
逻辑电平信号
- Contact Closure or Opening
触片闭合
- HIGH Radiation Level Relay De-energized When Signal Exceeds Set Point
当信号超过报警点时, 高辐射水平下继电器断开
- Equipment Failure Relay De-energized with Equipment Failure
设备故障继电器断开

Weight & Dimensions: 重量&尺寸
Size: 13.5" W X 11" H X 3.6"
尺寸:
Weight: 8 lbs
重量:

OPTIONAL: 可选

Junction Transfer Box: 接线盒

- Power Supply Signal 电源信号
- Detector Signal 探测器信号
- Communication Signal 通信信号
- Wall or Rack Mount – User Specified. 壁装或架装
- **Weight & Dimensions:** 重量&尺寸
- **Size:** 8" x 10" x 4"
- **Weight:** 10 lbs



OPTIONAL
JUNCTION TRANSFER
BOX



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ADDITIONAL SYSTEM DESCRIPTION: 补充系统描述

- Ion chamber is designed and built to withstand maximum temperature of 170°C and total integrated dose of 10^8 Rads.
电离室设计制作最大耐受温度 150°C, 总剂量 10^8 R
- Materials which might be compromised by these conditions are excluded from chamber construction.
电离室制作材料避免受这些条件影响
- Insulators in ion chamber are specifically mineral or treated glass materials.
电离室绝缘体为特殊矿物材料或处理过的玻璃材料
- Internal chamber itself is made primarily of stainless steel.
内室主要为不锈钢
- Length of this cable is determined by user when ordering, up to allowable maximum.
用户订货时提出缆线长度, 可到测量允许的最大长度
- Electrometer box specially built essentially eliminates possibility of extra cameral response.
静电计特外壳特殊设计根本上消除对外部辐射响应。

FM-9W ELECTRONICS MODULE: 电子学模块

- | | |
|---|---|
| • Installation
FM-9W & FM-9W Series HUB | 安装
Wall or Rack Mount – User Specified.
壁装& 支架安装 |
| • Processor:
FM-9W & FM-9W Series HUB | 处理器
Advanced processor computer |
| • High Voltage Power Supply:
FM-9W | Separately variable from 0 to 1500v. Extremely stable high voltage.
0-1500v 可变, 高压极其稳定 |
| • Monitor Display
FM-9W & FM-9W Series HUB | Monitor shows both real-time concentration & accumulated dose.
实时显示浓度和累计剂量 |
| • Read Out:
FM-9W | 读出
Data is shown alpha-numerically
数据字母-数字显示 |
| FM-9W Series HUB
FM-9W 系列转接器 | Data is shown both graphically & alpha-numerically.
数据图表&字母-数字显示 |



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IC-25 Ionization Chamber Detector:

Sensitivity: 灵敏度	1.3x10 ⁻⁹ amps R/hr
Slope: 斜率	0.10% per 100 Volts or less
Insulation value for inner chamber: 内室绝缘电阻	>4T ohms
Capacitance of inner chamber: 内室电容	<15 pF
Operating Voltage: 工作电压	-200 to -800 V
Keep Alive Source: 内置检测源:	10 µCi Cs-137



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PRE-AMPLIFIER: 前置放大器

- The pre-amplifier is a current to voltage amplifier.
前置放大器是一个电流转电压放大器
- Very high input impedance amplifier with high meg feedback resistors.
高输入阻抗放大器，高阻抗反馈电阻
- Input current starts from sub-pico amp range.
输入电流 范围从次微微（sub-pico）安培起
- Amplified voltage drives a pulse generator feeding into the LCD counter/display module.
放大的电压驱动脉冲发生器，反馈到 LCD 计数器/显示模块
- Ultra-quiet high voltage supply delivers a flat VDC as required.



DETECTOR CABLE: 探测器缆线

Mineral Insulated Cable:	2 each (HV and Signal)
矿物绝缘电缆:	各一根（高压和信号）
Length:	5 to 15 feet; Sheath: 0.250" O.D.
长度:	5-15 英尺，套外径 0.250"
Insulation:	High-purity (99.4%) Magnesium Oxide (MgO)
绝缘:	高纯氧化锰
Melting Temp.:	2500°F, 1370°C
熔点:	
Max. Temp. in Air:	1650°F, 900°C
空气最大温度:	

ADDITIONAL CABLE SPECIFICATIONS: 其它电缆规格

Sheath Diameter:	± 0.001 inch (± 0.0025 mm) or 1% of Nominal diameter, whichever is greater
线套直径:	标出直径 ± 0.001 英寸 (± 0.0025 mm) 或 1%，取数值较大者
Wall Thickness:	10% of sheath diameter as a minimum
壁厚:	最小为线套直径的 10%
Thermocouple Wire Calibration:	Meets Standard Limits of Error tolerance on calibration per ASTM E-230.



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热电偶校准: 符合 ASTM E-230 容错标准

Insulation Resistance At Room Temperature: 室温下隔离电阻
Greater than 1000 megohms@50VDC
(sheath diameters of 0.080 inch/ 2.0mm and less),
1000 megohms@500VDC
(sheath diameters of 0.120 inch / 3.0mm and greater).

High Temperature Insulation Resistance: 高温隔离电阻
0.040" diameter at 600°F (316°C) One foot length will be in excess of 10 megohms
0.62" diameter & larger at 600°F (316°C) One foot length will be in excess of 100 megohm

Dielectric Strength: *These are reference values for application to conductor cable only.*
绝缘强度: 电缆参考值

Data is at 60Hz and 70°F (21°C). 在 60Hz 和 70°F (21°C) 条件下数据
Straight: - 100VAC per mil of insulation thickness. **Bent:** - 45VAC per mil of insulation thickness.
直线时: 绝缘厚度每毫米 100VAC; 弯曲时: 绝缘厚度每毫米 45VAC

Temperature: Insulation Range: -450°F (-270°C) to 3000°F (1650°C) without change of phase or chemical reaction with adjacent metals.
温度: 绝缘范围: 无变相或与邻近金属反应情况下 -450°F (-270°C) - 3000°F (1650°C)

Melting Temperature of Insulation: 4800°F (2640°C). Limiting temperature is associated with metals used.
熔点: 4800°F (2640°C). 温度极限与使用金属有关

Pressure: Can withstand external pressure up to 50,000psi (3500kg/cm²).
压力: 可承受外部压力 50,000psi (3500kg/cm²).

Nuclear: Insulation can be subjected to a mean neutron flux of 2X10¹¹n.cm⁻²S⁻¹ @100°C and a total peak irradiation of 8X10¹⁸n.cm⁻² with no significant change in characteristics.
辐射环境: 绝缘可能受 100°C 时平均中子通量 2X10¹¹n.cm⁻²S⁻¹ 和总峰值辐射 8X10¹⁸n.cm⁻² 影响, 无显著特征变化。

Formability: Can be bent around a mandrel having a radius equal to twice the sheath diameter without rupturing the sheath or causing loss of insulation resistance.
可塑性: 可缠绕四倍粗芯棒而不损坏线套或影响其绝缘性。

Fabrication: Sheath can be welded, brazed, and soldered using normal care for the metals and thickness involved without changing insulation resistance.
锻造: 线套可以正常焊接, 钎焊而不改变其绝缘性。



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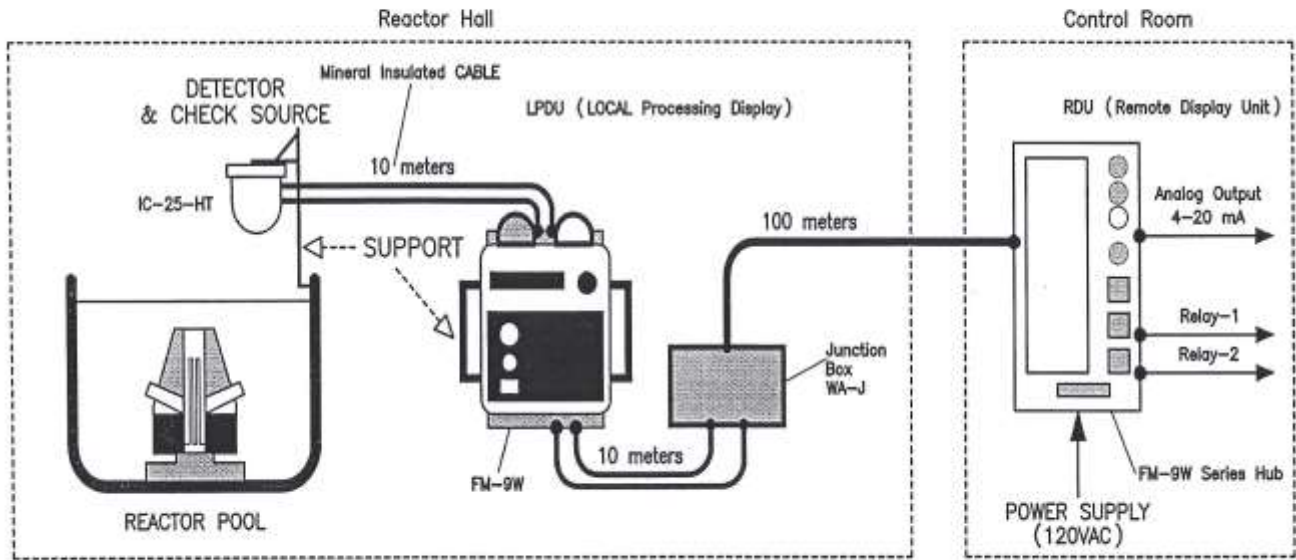
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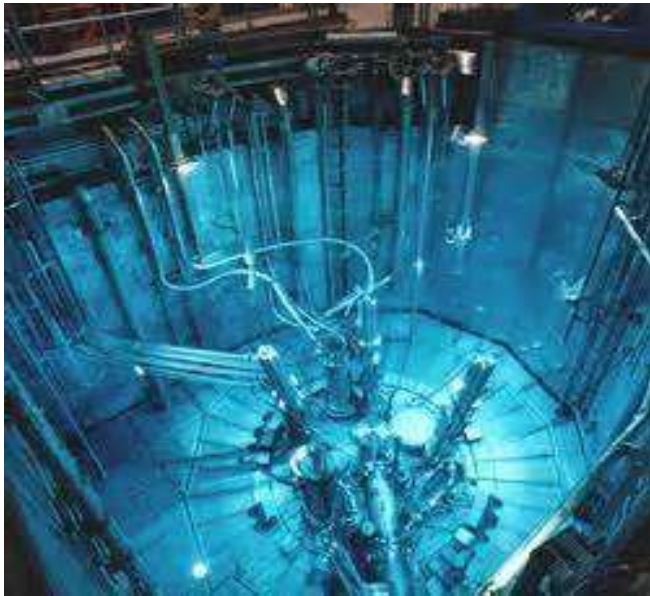
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燃料池表面辐射监测系统



燃料池



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