MOHR™ EFP-IL
Guided Ultra-Wideband (UWB) Radar Tank Level Indicator (TLI) System
Next-generation liquid level measurement system designed for nuclear applications

**EFP System Key Features**
- Industry's most accurate liquid level measurements
- System designed specifically for nuclear applications
- Characterize boiling / frothing environments
- Electronics can be >300 m (1000 ft.) from probe
- In-situ instrument calibration
- Inline probe signal-path integrity monitoring
- Ideal for use with MOHR SFP-1 spent fuel pool probe

MOHR EFP Series Guided UWB Radar sensors utilize MOHR’s Electric Field Perturbation technology and are the industry’s most accurate liquid level / TLI sensors. With thousands of hours of reactor system operation, EFP Series instruments are ideal for nuclear tank level monitoring applications including Spent Fuel Pool Instrumentation (SFPI).

**Features and Benefits**

**Unmatched Precision and Accuracy**
EFP signal processors offer precision and accuracy of approximately 0.1 mm (0.004 in.) and 1 mm (0.04 in.), respectively. Real-world TLI system accuracy, taking probe surface tension effects into account, is better than ± 12.5 mm (0.5 in.) for most industrial applications.

**Measure Multiphase Flow Conditions**
Characterize frothing / boiling environments that can fool legacy TDR / guided-radar systems. Optionally integrate true volumetric void fraction measurement for real-time estimation of total coolant inventory and enthalpy.

**Rugged Performance For Any Environment**
Wall-mount instrument with NEMA 4X enclosure designed to meet applicable MIL-SPEC and NRC seismic, shock, vibration, environmental, and EMC requirements.

**Intuitive, Informative Interface**
- Graphical user interface reports instantaneous level in units of length and/or calibrated volume.
- Level history graph lets the operator quickly evaluate recent trends in tank level and compare to level alarm settings. Stores historical data in flash memory.

**Multiple Interface and Configuration Options**
- Ethernet, USB, 4-20 mA, 802.11 b/g/n WiFi
- Remote monitoring and configuration over Ethernet
- Single and dual channel configurations
- Optional military-grade level alarm relays
- Optional thermocouple signal processor

**MOHR SFP-1 Spent Fuel Pool Probe Assembly**
- Configurable lengths of 1.5 - 10+ m (5 - 32+ ft.)
- MIL-SPEC hardened, exceeds Seismic Category I
- Long term use at 250°C (480°F) or above
- Excellent long-term radiation resistance
- EFP-IL/HL interconnect cable >300 m (1000 ft.)
- Relative accuracy 2.5 mm (0.1 in.) at 300 m (typ.)
- Absolute accuracy ± 25 mm (1 in.) at 300 m (typ.)
- Compatible with EFP system in-situ calibration
Specifications

Level Measurement System
Advanced liquid level measurement capabilities:
- Very low dielectric measurement capability ($\varepsilon_r > 1.1$)
- Liquid/liquid interface, boiling, and froth detection
Level measurement precision: 0.1 mm (0.004 in.)
Accuracy:
  - Absolute measurements: 1 mm (0.04 in., max.)
  - Real-world accuracy: better than 1.5 mm (0.05 in., typ.)
Response time: -2 ms (min.)
Level alarms: multiple individually-configurable alarms
Level alarm hysteresis: user-configurable
Level display: length or calibrated volume units
*Inline TDR signal path integrity verification
*Raw backscatter data storage, post-processing capability
* Laboratory setting, excluding surface tension effects.
** Ruggedized probe in industrial setting, including surface tension effects.

Void Fraction Measurement System Option*
Accuracy: 1% (steam-water system, bubbly flow)**
Range: 0-100% void
Resolution: 0.1% void (typ.)
* Specialized system hardware/firmware and probe required.
** May vary by application due to flow characteristics and probe geometry.

Connectivity Options
USB host/client, 10/100 Ethernet, RS-232
2x 4-20 mA (loop-powered), 1x HART-compliant modem
802.11 b/g/n WIFI (WPA2 256-bit AES encryption)
Level alarm relays (optional):
2x SPDT 30 VDC/120 VAC relays

Thermocouple Signal Processor Option
K-type (Chromel/Alumel), cold-junction compensated
Range: -270°C to +1372°C
Resolution: 0.25°C
Accuracy: ±2°C (-200°C to +700°C)

RTD Signal Processor Option
Uses 1000 to 1kΩ platinum RTDs (PT100 to PT1000)
Compatible with 2-, 3-, and 4-wire sensor connections
Range: -200°C to +250°C (typ.)
Resolution: 0.03125 °C (may vary due to RTD nonlinearity)
Accuracy: 0.5°C (0.05% of full scale) max.

Display
Color LED-4.3 in. (10.9 cm) QVGA TFT-LCD, > 600 cd/m²
Discrete LED status light

Data Storage
Standard 2 GB flash memory storage

Power System
AC Power: 90-264 VAC, 47-63 Hz
DC Power: 9-36 VDC, 1.5A @ 24 VDC max.
Hybrid NiMH battery backup, >7d operation*
* Seamless transfer to backup power upon loss of external power.

Environmental and Mechanical
Operating / Non-Operating Temp.: -10°C to +55°C / -20°C to +85°C
Mechanical:
- EFP-IL Signal Processor:
  30.5 (H) x 25.4 (W) x 21.0 (L) cm (12.0 x 10.0 x 8.3 in.)
  12.7 kg (27.9 lbs.)
- EFP-BAT-44000 External Battery Enclosure:
  36.5 (H) x 30.5 (W) x 16.30 (L) cm (14.0 x 12.0 x 6.3 in.)
  18.9 kg (41.6 lbs.)
- NEMA 4x 304 SS enclosure with ANSI 61 gray powder coat (optional)
- Panel/wall or Unistrut P1000 mounting

Regulatory
SPFI System (EFP-IL and EFP-BAT-44000)
Tested to meet the following standards:
IEEE 344:2004 Seismic (14.0 g 59.5E, 9.8 g OBE)
IEC 60668-2-27 Shock
IEC 60668-2-8 Vibration
EPR1 TR-102263-83 EMC
MIL-STD-108 Environmental, MIL-5-901D Shock,
MIL-STD-167-1 Vibration, MIL-STD-461F EMC,

Designed to meet relevant requirements for Naval shipboard liquid level indicating equipment pursuant to MIL-L-23886C and
ASTM F 2044-00.

Complies with all applicable EU directives, as specified by the Declaration of Conformity supplied with the instrument.

Complies with Canadian ICES-003.

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