Measurements International

Metrology is Our Science, Accuracy is Our Business™

Transformer and Reactor Loss Measurement Systems TLMS and RLMS

Accurate. Proven. Fast.

www.mintl.com • sales@mintl.com

Confidence in Every Transformer You Deliver

You are expected to meet strict efficiency guarantees—on time and without risk.

Loss measurement is where that performance is proven. At low power factors, even small uncertainties can impact margins, delay shipments, or lead to disputes.

That's why manufacturers rely on AccuLoss® (TLMS) and Reactor Loss Measurement Systems (RLMS) from Measurements International—delivering metrology-level accuracy on the factory floor.

Confidence That Protects Your Business

Accurate. Defensible. Compliant.

- High-precision measurement at extreme low power factors
- Results you can trust and defend in any test or audit
- Fully aligned with IEC 60076
- SF6 Free Systems available up to 200 kV

Performance That Drives Results

- Increase throughput with fast, stable measurements
- Operate with confidence in real-world conditions
- Simplify testing with intuitive, automated workflows

Complete Loss Measurement Coverage

- TLMS – Transformer and Reactor loss measurement for production environments
- RLMS – Dedicated reactor loss measurement systems
- One integrated solution across your full product range

The Result

- Reduced financial risk
- Improved production efficiency
- Greater confidence in every test
- Fully Customizable solutions for your exact requirements

Confidence That Wins Business

With TLMS and RLMS, you remove uncertainty from loss measurement—and gain a competitive advantage on every unit you deliver.

Features & Benefits

Feature	Benefit
Industry-Leading Measurement Accuracy	Ensures confidence in results, even at PF = 0.01, supporting compliance with global standards and improving product quality.
Simultaneous Sampling Technology	Eliminates phase errors and delivers fast, stable, and highly repeatable measurements.
Scalable to 6000 A / 800 kV	Supports testing from distribution to ultra-high-voltage transformers within a single platform.
Modular System Architecture	Enables easy upgrades and integration into existing facilities, protecting long-term investment.
Flexible Test Configurations	Accommodates horizontal and vertical bushings and a wide range of transformer designs.
Optimized for Low Power Factor	Maintains high accuracy under the most challenging measurement conditions.
Supports Energy-Efficient Design	Helps manufacturers reduce transformer losses and meet increasing efficiency requirements.
Environmentally Responsible Design	Contributes to reduced emissions and supports ESG and sustainability initiatives.

Overview

The AccuLoss® Transformer Loss Measurement System (TLMS) and Reactor Loss Measurement Systems (RLMS) from Measurements International Limited are metrology-grade solutions designed for precise measurement of transformer and reactor losses. Engineered for modern high-voltage testing, these systems deliver industry-leading accuracy, even under challenging conditions such as extremely low power factor measurements (PF = 0.01).

Using precision voltage dividers and advanced simultaneous sampling power analyzer technology, TLMS and RLMS provide fast, stable, and highly repeatable results, making them well suited for both production and laboratory environments.

Built on proven metrology principles, the system is simple to calibrate using traceable reference standards. This reduces complexity and downtime while ensuring long-term confidence in measurement accuracy. The modular and scalable architecture supports configurations up to 800 kV and 6000 A, enabling seamless integration into new or existing test facilities across a wide range of applications.

The system supports a comprehensive range of testing applications, including load and no-load loss measurements, heat run testing, induced voltage testing, and reactor calibration at very low power factors. Integrated software provides automated test sequences, waveform analysis, and flexible data output, improving efficiency while maintaining consistent, high-quality results.

Optional oil-filled current transformers (CTs), including electronically aided and compensated designs, further extend system capability—allowing a single platform to support both transformer and reactor testing with high accuracy and stability. This option removes the need for bushings.

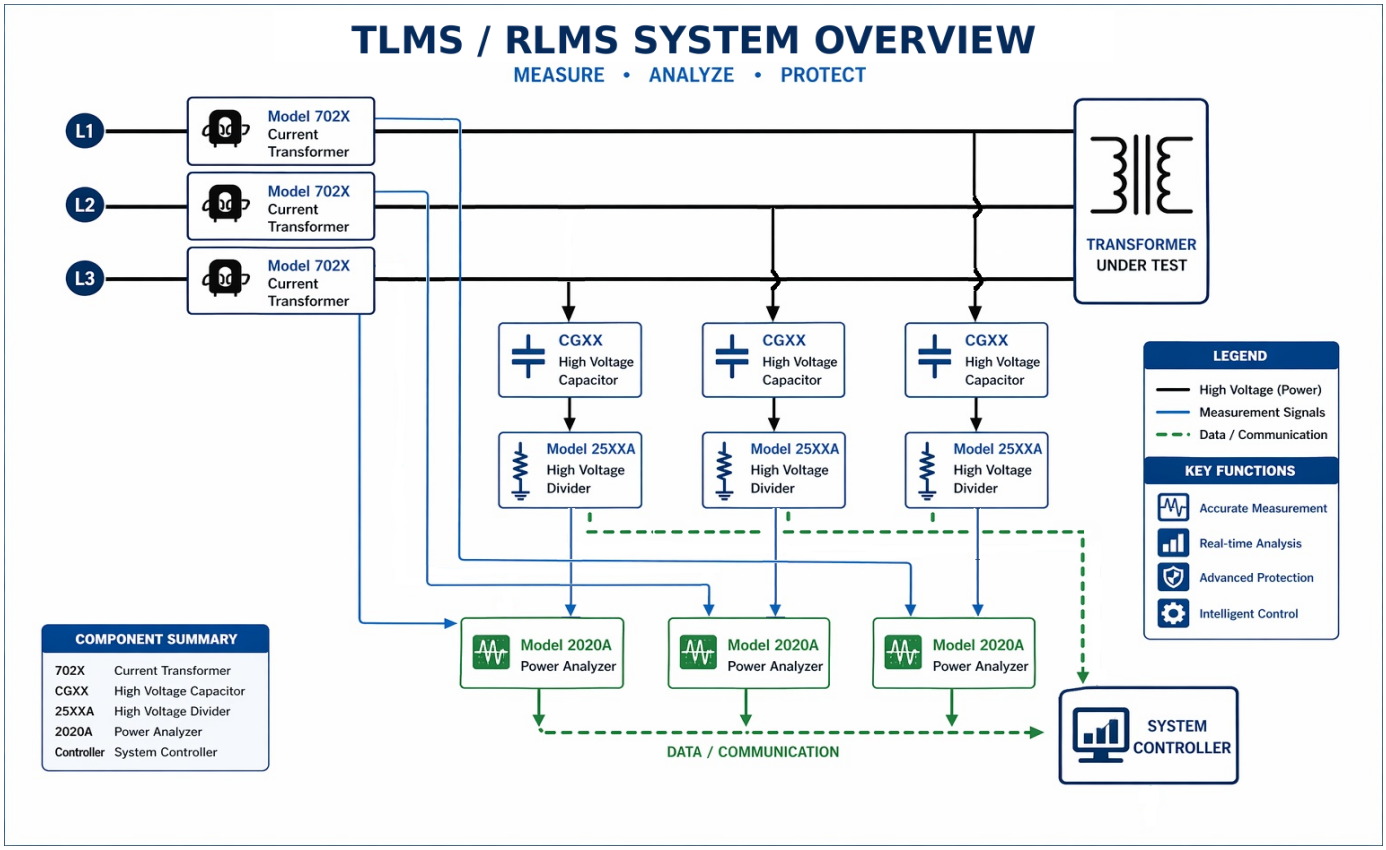
Capabilities and Applications

Accurate. Defensible. Compliant.

- Performance of Load and No-Load Loss Measurements
- Heat Run Test
- Induced Voltage Test
- Zero Sequence Impedance Measurements
- “Operator Friendly” software includes voltage and current waveform analysis, manual and fully automatic time-saving range selection, over-voltage, and over current protection.
- **Output Data:** Supplied in an ASCII file for easy import into Excel spreadsheets.
- **Electromagnetic Compatibility:** All components comply with the requirements of IEC Recommendations. In addition, the electronics is housed in one shielded enclosure.

The AccuLoss® System is designed to test small, medium, and large power transformers, motors, and turbines up to 400 Hz and is ideal for R & D facilities. The AccuLoss® System also calibrates single and 3-phase reactors at power factors down to 0.001 and lower.

Standard Configuration



Power Factor Accuracy Performance

Power Factor	Range	Accuracy
cos Φ = 1.000	≥ 100 V ≥ 1 A	0.03 %
cos Φ = 0.100	≥ 100 V ≥ 1 A	0.04 %
cos Φ = 0.050	≥ 100 V ≥ 1 A	0.06 %
cos Φ = 0.020	≥ 100 V ≥ 1 A	0.13%
cos Φ = 0.010	≥ 100 V ≥ 1 A	0.27 %
cos Φ = 0.005	≥ 100 V ≥ 1 A	0.54 %
cos Φ = 0.001	≥ 100 V ≥ 1 A	2.74%

Accuracy specifications are calculated for an ambient temperature of 25 °C, ± 10 °C, and are of full scale. If the ambient temperature is less than or greater than 10 °C, contact Measurements International for an updated accuracy specification.

Yokogawa Power Analyzer Configuration

For customers who do not require the highest accuracy level provided by MI's 2020A-based TLMS and RLMS systems, Measurements International offers an optional configuration using a single Yokogawa precision power analyzer/wattmeter.

This configuration provides a practical, lower-complexity measurement solution for transformer and reactor loss testing applications where standard production testing requirements are the primary focus and ultra-low uncertainty performance is not required. By replacing multiple MI 2020A Power Analyzers with one Yokogawa instrument, the system reduces hardware complexity while still supporting reliable and repeatable loss measurement.

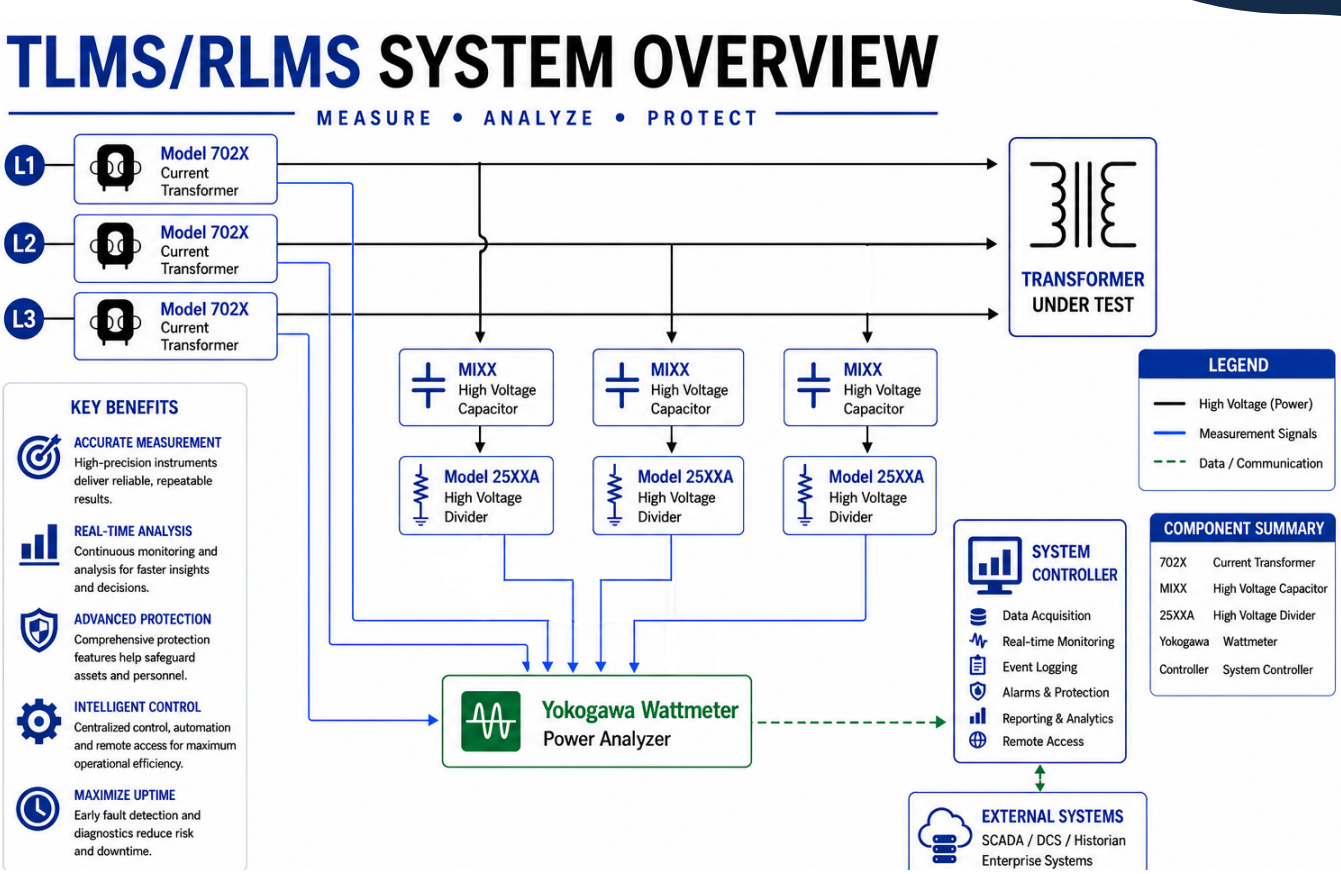
The Yokogawa-based configuration is ideal for customers seeking a cost-effective and simplified system option, while the MI 2020A-based configuration remains the recommended choice for customers requiring the highest level of metrology-grade accuracy, low power factor performance, and reference-level measurement confidence.

Measurement Configuration Comparison

Choose the right TLMS / RLMS architecture based on accuracy requirements and application needs.

Category	MI 2020A-Based TLMS / RLMS System	Single Yokogawa Wattmeter Configuration
Best Suited For	Customers requiring the highest accuracy, low power factor performance, and metrology-grade measurement confidence.	Customers with standard production testing needs and less demanding accuracy requirements.
Accuracy Positioning	Premium reference-grade system performance.	Practical solution when the full accuracy level of the MI 2020A system is not required.
Power Measurement	Uses multiple MI 2020A Power Analyzers as part of the measurement architecture.	Uses a single Yokogawa precision wattmeter / power analyzer.
System Architecture	High-performance configuration optimized for the most demanding measurement applications.	Simplified, lower-complexity configuration for routine loss measurement applications.
Primary Advantage	Maximum measurement confidence and premium low power factor performance.	Reduced complexity and a more cost-effective solution.
Recommended When	The application demands the highest level of accuracy and metrology-grade confidence.	The application does not require the full accuracy level of the MI 2020A-based system.

MI 2020A-based systems remain the recommended choice for the highest-accuracy TLMS and RLMS applications.



Power Factor Accuracy Performance Yokogawa

Power Factor	Range	Accuracy
cos Φ = 1.000	≥ 100 V ≥ 10 A	0.06 %
cos Φ = 0.100	≥ 100 V ≥ 10 A	0.22 %
cos Φ = 0.050	≥ 100 V ≥ 10 A	0.42 %
cos Φ = 0.020	≥ 100 V ≥ 10 A	1.04%
cos Φ = 0.010	≥ 100 V ≥ 10 A	2.06 %
cos Φ = 0.005	≥ 100 V ≥ 10 A	4.11 %
cos Φ = 0.001	≥ 100 V ≥ 10 A	5.20%

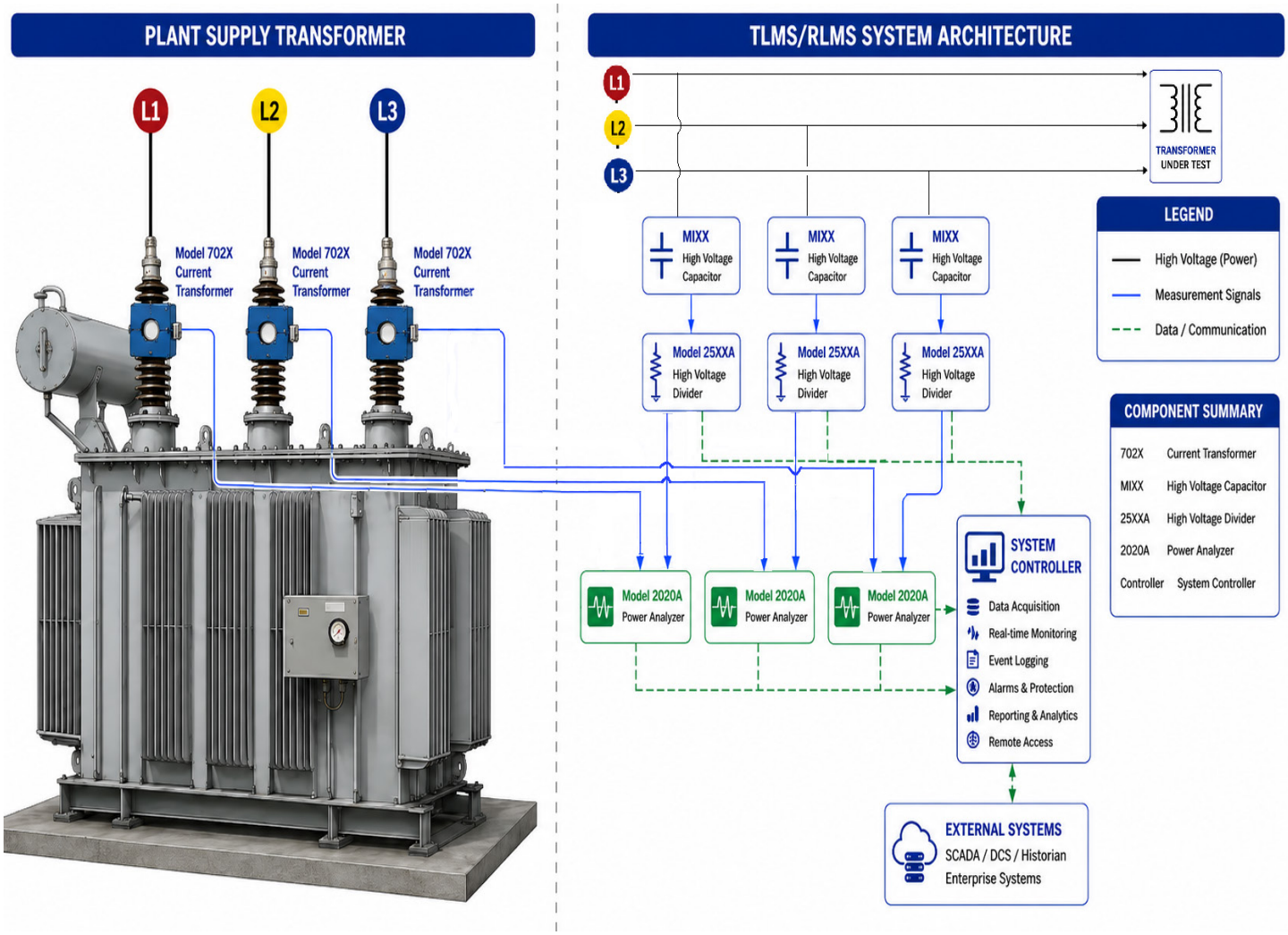
Accuracy specifications are calculated for an ambient temperature of 25 °C, ± 10 °C, and are of full scale. If the ambient temperature is less than or greater than 10 °C, contact Measurements International for an updated accuracy specification.

Oil-Filled CT Configuration

For applications where a dedicated set of high-voltage bushings is not required or practical, Measurements International can supply the TLMS or RLMS with oil-filled current transformers mounted directly on the plant supply transformer bushings.

This configuration allows the system to measure current from the existing supply transformer outputs, eliminating the need to provide separate high-current bushings as part of the loss measurement system. By integrating the CTs at the transformer bushing outputs, customers can reduce system footprint, simplify the high-voltage layout, and lower the amount of additional high-voltage hardware required for the test facility.

The oil-filled CT option is well suited for installations where the plant supply transformer is already part of the test infrastructure and where a cleaner, more integrated current measurement solution is preferred. It maintains the TLMS/RLMS measurement architecture while offering a practical alternative to separate bushing assemblies.



SF6 Free TLMS and RLMS Systems

Supporting Future Regulatory Requirements

Governments and regulatory bodies around the world are placing increasing pressure on the use of SF_6 gas due to its extremely high global warming potential and long atmospheric lifetime. As regulations continue to move toward the reduction, restriction, or phase-out of SF_6 in electrical equipment, transformer and reactor manufacturers are looking for test systems that reduce future environmental and compliance risk. Measurements International offers an **SF_6-free options for AccuLoss® TLMS and RLMS systems up to 200 kV**, providing transformer and reactor manufacturers with a cleaner, lower-maintenance alternative to traditional gas-insulated high-voltage measurement systems.

By eliminating SF_6, the system helps reduce environmental impact, simplify long-term ownership, and support customers working toward stricter ESG, sustainability, and regulatory requirements. The SF_6-free design maintains the high accuracy, stability, and repeatability expected from MI's metrology-grade loss measurement systems, while reducing the operational burden associated with handling, monitoring, and maintaining SF_6 gas.

Portable Systems

For customers requiring greater flexibility, Measurements International can offer the TLMS or RLMS as an optional portable measurement system. This configuration is designed for applications where the system may need to be moved between test bays, transformer lines, reactor test areas, or used for specialized factory and field measurement requirements.

The portable system maintains the same metrology-grade measurement performance as the fixed TLMS/RLMS configuration, while providing a more flexible setup for facilities that do not require a permanently installed system. Precision voltage, current, and power measurement components can be supplied in a transportable arrangement, allowing users to perform accurate transformer or reactor loss measurements where and when required.

This option is ideal for manufacturers, utilities, and laboratories looking to expand testing capability without committing to a dedicated permanent installation. It provides a practical solution for multi-location testing, temporary test setups, system upgrades, and production environments where test flexibility is important.

Simple 5-Step Selection Process

1. **Select System Type**
   →TLMS or RLMS
2. **Choose Current Rating**
   → (kA requirement)
3. **Choose Voltage Rating**
   → (kV requirement)
4. **Select Configuration**
   → Horizontal / Vertical / Oil CT

   Note:
   Horizontal Bushing only available up to 100 kV

   Note:
   Stand Alone CT Only Available in RLMS Systems
5. **Select Class**
   → Standard or Premium or Yokogawa

MODEL SELECTION GUIDE

AccuLoss® Transformer (TLMS) & Reactor Loss Measurement Systems (RLMS)

TLMS – 2100 – V – P

- P → System Class (**S**tandard / **P**remium / **Y**okogawa)
- V → Configuration (**H**orizontal / **V**ertical/**O**il) CT
- 21 → Rating Code (1st digit Current in kA, next is kV)
- TLMS → System Type (TLMS / RLMS)

Example:

TLMS-2100-V-P → 2 kA, 100 kV, Vertical, Premium System

For Portable Systems and SF6 Free Systems please request at time of quotation

Transformer Loss Measurement Systems (TLMS)

Model Series	Maximum Current	Voltage Capability
2100 – 2300	Up to 2 kA	Up to 300 kV
3100 – 3300	Up to 3 kA	Up to 300 kV
4100 – 4300	Up to 4 kA	Up to 300 kV

Reactor Loss Measurement Systems (RLMS) with Stand Alone CT

Model Series	Maximum Current	Voltage Capability
2300 – 2800	Up to 2 kA	300 – 800 kV
4300 – 4800	Up to 4 kA	300 – 800 kV
6300 – 6800	Up to 6 kA	300 – 800 kV

Calibration and Support Options

Measurements International offers flexible calibration support for TLMS and RLMS systems. Complete Onsite system calibration can be performed using MI's 7010 Capacitance Bridge, providing a proven and traceable method to verify system performance.

For customers who require component-level calibration, MI also offers a loaner program to help eliminate system downtime. Individual components can be returned to MI one at a time for calibration while a loaner unit remains in service, allowing customers to continue operating their test system with minimal interruption.

Specifications: Premium/Standard Systems

HV Bushing Style	Horizontal			Vertical		
Voltage						
Applied Voltage Line to Neutral	100 V to 100 kV			100 V to 100 kV	100 V to 200 kV	100 V to 300 kV
Accuracy	≤ 0.05 % of full scale					
Current						
Applied Current (A)	1 to 2000	1 to 4000	1 to 6000	1 to 4000	1 to 6000	1 to 4000
Input Current Ratio	2000:1			2000:1		
Accuracy	≤ 0.005 % of full scale					
Ranges, A (Blue - Premium) Note: All CT's are protected against power outages.	10 20 40 100 200 400 1000 2000	10 20 40 100 200 400 1000 4000	10 20 40 100 200 400 1000 6000	10 20 40 100 200 400 1000 4000	10 20 40 100 200 400 1000 6000	10 20 40 100 200 400 1000 4000
Power						
Power Factor	1, 0.1, 0.05, 0.02, 0.01, 0.005, 0.002, 0.001					
Accuracy	≤ 0.03% to ≤ 2.74 %					
Saftey Clearances						
To Adjacent Walls	1.3 m			2.6 m : 3.9 m for 300 kV		
Between Phase	1.3 m			2.6 m : 3.9 m for 300 kV		
Power Supply						
Voltage	100, 120, 220, 240 V ± 10 %					
Frequency	50/60 Hz					
Power	1200 VA					
Environmental Conditions						
Operating Temperature	Control Cabinet: 15 °C to 30 °C, Bushings and Capacitors: 0 °C to 40 °C					
Storage Temperature	- 20 °C to 50 °C					
Relative Humidity	30 % to 90 % (non condensing)					

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