

Technical Specifications for Distribution Transformer Monitoring System (DTMS)

1. Device Compatibility

- Must support installation on the following transformer types:
 - Pole-mounted (single-phase and three-phase)
 - Pad-mounted (single-phase and three-phase)
 - Submersible network transformers (three-phase)

2. Electrical Measurement Requirements

- Primary current monitoring (min. 100 A typical, expansion-capable)
- Secondary current monitoring (up to 4000 A per phase)
- Secondary voltage monitoring (90–480 VAC)
- Power metrics:
 - Active Power (Watts) $\pm 1.5\%$ accuracy
 - Reactive Power (VAR) $\pm 2\%$ accuracy
 - Energy consumption (Wh) $\pm 1.5\%$ accuracy
 - Power factor ($\pm 1\%$)
 - Line voltage and current accuracy: $\pm 0.5\% / \pm 1\%$

3. Power Quality and Event Detection

- Voltage sag/swell detection
- Load imbalance and phase imbalance analytics
- Oscillography (waveform capture)
- Arc detection (optional)
- Tamper/theft detection
- Last-gasp outage notification (on power loss)

4. Physical and Environmental Sensing

- Transformer surface temperature (up to 150°C / 302°F)
- Internal oil pressure (up to 30 psi, ± 0.5 psi accuracy)
- Tilt sensing ($\pm 180^\circ$, 1° resolution)
- Impact/shock detection (up to 8g)
- Flood sensor support (internal or external input)
- Fire, smoke, or intrusion detection (optional)

5. Communications and Protocols

- Built-in 4G LTE modem (Cat-1 or Cat-M1)
- Support for 900 MHz licensed radio (optional)

- Protocol support:
 - MQTT / HTTPS API
 - Modbus TCP, DNP3 (via Ethernet or secure IP channel)
 - OTA (over-the-air) firmware update capability

6. Integration and Interoperability

- Integration with utility systems: SCADA, OMS, DMS, ADMS, Asset Management
- GIS location support via built-in GPS
- Programmable alert thresholds and triggers (load, voltage, etc.)
- Support for network protector status, door alarms, flood switches

7. Mechanical and Environmental Ratings

- Ingress protection rating: IP67 minimum (IP68 preferred for submersible use)
- Impact resistance: IK08 minimum
- Operating temperature range: -40°C to +70°C
- Enclosure rated for pole or vault mounting

8. Device Management and Platform Features

- Cloud dashboard or web-based local interface
 - Unified view of all connected devices (single-pane-of-glass monitoring)
 - Hosted data for both historical trends and real-time insights
 - Power quality analysis to monitor voltage, current, and electrical anomalies
 - API access for seamless data integration and automation
 - Map-based asset visualization for geographic context and tracking
 - Performance metrics to evaluate system health and efficiency
 - Historical trend visualization and reporting
 - Remote configuration of assets
- Real-time alarms and health diagnostics
- Role-based access control and data encryption (128/256-bit)

9. Warranty and Service

- Minimum 5-year warranty required (10 years preferred)
- Included support for firmware and software upgrades over the device lifetime
- Vendor must provide onboarding/training support and 24/7 technical assistance

10. Compliance and Cybersecurity

- Compliance with relevant ANSI/IEEE/NEMA standards
- Secure firmware with signed OTA updates
- TLS-encrypted communications
- Support for TPM, secure boot, or other tamper-resistant hardware features